

R
853
U56167
1968

DIVISION OF RESEARCH SERVICES

ANNUAL REPORT

FY 1968



R
853
156167
1968

United States National Institutes of Health
DIVISION OF RESEARCH SERVICES

Report of Program Activities
July 1, 1967, through June 30, 1968

LIBRARY

JUL 27 1968

National Institutes of Health

CONTENTS

	Page
Division of Research Services-----	1
Research Facilities Planning Branch-----	7
Plant Engineering Branch-----	21
Laboratory Aids Branch-----	39
<u>Individual Project Reports</u>	
1. Chronic Murine Pneumonia of the Albino Rat-----	51
2. Focal Necrosis of the Liver of Rabbits-----	52
3. Febrile Hemorrhagic Disease of Monkeys-----	53
4. Canine Blood Donors-----	55
5. The Effects of a Hematinic on the Blood Picture of Donor Dogs-----	57
6. Canine Hemolytic Anemia-----	58
7. Hematologic and Bacteriologic Characteristics of Stored Canine Blood-----	59
8. Feed Consumption Studies in the Canine-----	61
Environmental Services Branch-----	63
Biomedical Engineering and Instrumentation Branch-----	73
<u>Individual Project Reports</u>	
1. Mathematical Analysis of Pharmacokinetics - Cancer Chemotherapy-----	88
2. Mathematical Analysis of Pharmacokinetics - Effect of Artificial Kidney-----	89
3. Segmented Polyurethane-----	91
4. Myocardial Infarction Research Unit Instrumentation and Data Acquisition Systems-----	93
5. Rat Identification System-----	94
6. Artificial Heart Assist System-----	95
7. Automated Serological Scanner System-----	96
8. Physical Correlates of Animal Colony Behavior-----	97
9. Automated Amino Acid Analysis-----	98
10. Automated Sample Combustion System-----	99
11. Utility of Lasers in Biological Research and Clinical Applications-----	100
Library Branch-----	103
Medical Arts and Photography Branch-----	109

NATIONAL INSTITUTES OF HEALTH

DIVISION OF RESEARCH SERVICES

Report of Program Activities
July 1, 1967, through June 30, 1968

A. Objectives

The objective of this Division is to provide scientific, technical, and engineering services to support and further the research programs of the National Institutes of Health. Since all of these services are geared to the needs of the Institute programs, the Division makes a continuous effort to keep informed of Institute plans. The Division's organization, staffing, and functions are adjusted accordingly to maintain an effective program of centralized services.

B. Current Programs

The Division of Research Services comprises some 1,300 persons with almost 200 individual occupational skills and is composed of an Office of the Director and seven branches: Biomedical Engineering and Instrumentation, Environmental Services, Laboratory Aids, Library, Medical Arts and Photography, Plant Engineering, and Research Facilities Planning.

The programs of the Division can be divided into two broad classifications:

1. Programs in direct support of research

- a. Design, development, and fabrication of instruments and materials
- b. Biomedical engineering of methods and systems
- c. Production of bacteriologic and tissue culture media
- d. Preparation of sterile glassware
- e. Production of genetically defined rodents and rabbits
- f. Quarantine and conditioning of dogs, cats, and primates
- g. Maintenance of farm animals
- h. Animal surgery and recovery
- i. Animal health services
- j. Still and motion picture photography
- k. Graphic arts services and exhibits design
- l. Medical illustration and model making
- m. Library services
- n. Foreign language translation

2. Programs related to NIH facilities and proper environment

- a. Engineering liaison in the design and construction of new NIH facilities
- b. Development of improved facilities and equipment

- c. Operation, maintenance, and repair of NIH physical facilities
- d. Professional engineering and craft services for alterations, improvements, and installations
- e. Maintenance of NIH grounds
- f. Environmental services designed to maintain and improve the health of NIH patients and employees

C. Program Progress and Accomplishments

During FY 1968 the Office of the Director sought to strengthen management of DRS activities by realigning functions within and among several of the branches.

The most extensive area of reorganization concerns the Research Facilities Planning Branch and the Plant Engineering Branch. In order to handle NIH's increased construction and maintenance workloads, RFPB was divided into an Engineering Design Branch and a Construction Engineering Branch. At the same time, the engineering design and construction activities of PEB were transferred into the appropriate new branch, with PEB retaining responsibility for operation, maintenance, and alterations of the NIH buildings and grounds. The reorganization was approved and is scheduled to be implemented early in FY 1969.

In another change, the sectional structure of the Environmental Services Branch was reorganized to enable the branch to be more responsive to Institute needs. The branch organization is now based on functional programs rather than professional disciplines, and recognizes the growing role of biohazards control as a prime factory in maintaining a satisfactory environment.

The Division will continue to examine its functions throughout FY 1969. Changes in I/D programs will be evaluated in terms of possible impact on our service areas. Where realignment, elimination, or addition of new functions is indicated, appropriate reorganizations will be implemented.

The successful recruitment of a Chief for the Medical Arts and Photography Branch further strengthened Division efforts to provide the most effective supporting services to Institute programs.

Workload Measurement

Installation and refinement of the workload measurement and management reporting systems continues to occupy a position of high priority among OD/DRS projects. The Division's management analysis staff has been strengthened with measurable results. The availability of meaningful workload data has proven to be of invaluable assistance to the Financial Management Branch, OAM, by significantly reducing the amount of time required to convert operations to fee-for-service financing. Prior to

implementation of the current work measurement system, financial accounting studies required 8 to 12 months to accumulate cost data. Cost feasibility can now be determined within a matter of weeks. An important feature of the management reporting system is the identification, by I/D's of how DRS manpower resources are distributed. The impact of I/D program changes can be evaluated more precisely knowing the approximate percentage of manpower provided to a specific Institute.

Training

The Division continues its efforts to develop and implement a career development training program for personnel at all grade levels. Additional needs will be identified during FY 1969, with priority given to improved management development of Branch Chief and key line personnel. Training and management goals will be explored and defined with the objective of developing an environment which will increase cross-pollenization of ideas at every working level.

Supervisor-employee relationships will be examined and strengthened with major emphasis placed on techniques for developing employee commitment to the overall mission of the Division. A full-time Training Officer will be assigned to the Division to serve as a stimulant, resource, and focal point for all training and development activities.

Construction

In FY 1968, a record pace continued in design and construction associated with the expansion of NIH facilities. The current program includes more than 20 projects in various stages of planning, design, or construction, having a total cost in excess of \$100 million. Eleven projects were under construction during the year. The Gerontology Research Center, a 200,000+ square foot laboratory building located on the Baltimore City Hospitals grounds, was completed. Also, three major construction projects were carried to virtual completion during the year. The projects are the NCI Virus Isolation Facility, located southwest of the National Library of Medicine, the Library and Cafeteria additions to the south side of the Clinical Center, and the 2-story addition to Wing D, south side of the Clinical Center. On the NIH reservation, major expansion of the utilities distribution system disrupted many roads and parking areas with some personal inconveniences. The major part of this work is now finished. The design of several projects, including two multilevel parking facilities, is nearly complete and these projects should be under construction next year.

Animal Programs

Major emphasis was placed upon data processing of production and animal issue information, to achieve greater efficiency in the utilization of limited production facilities. Efforts were also made to establish more meaningful communications with the Institutes and Divisions regarding their current and future requirements for experimental animals.

Programs to improve the quality of all animals furnished to intramural research programs were continued and intensified. For the first year in recent history, the rodent and rabbit production colonies experienced no major outbreaks of disease. Significant improvements were made in the quality of the random source dogs and cats issued. This is directly attributable to the lengthening of the conditioning period from 30 to 45 days.

A development of singular importance, the successful establishment of a large colony of donor dogs to furnish whole blood, has resulted in a significant reduction in the numbers of dogs required for research purposes at NIH. The furnishing of blood, coupled with improvements in the health status of conditioned random source dogs, reduced the needs for dogs by 786 animals. Projected dog issues for the year will be 3,612, the fewest number of dogs issued since FY 1960.

Library Services

The NIH Library moved into a new facility, providing more than twice as much total space, 42,500 square feet, and accommodating twice as many patrons as the former Library.

A journal evaluation was conducted by 75 scientists representing various subject specialties. A listing of periodical titles recommended for addition to the collection has been compiled. A list of titles recommended for deletion is in process.

Automation within the Library Branch was concentrated in two areas: businesslike transactions, such as serials recording and acquisitions, and publications. Automation of circulation procedures, including overdues, was also given some attention.

A total of 39,000 books and journals were circulated during FY 1968. Approximately 7,500 were loaned, and 8,500 were borrowed from other libraries. Approximately 5,200 copies of translations were provided to other libraries. Also, the Library's collection was strengthened by the addition of 4,500 new books and by the receipt of 500 books through gift and exchange. For FY 1968, the Library placed subscriptions to more than 2,227 journal titles and received an additional 800 as gifts or on exchange.

The Branch Chief announced his resignation effective July 15, 1968, to accept appointments as Director, Health Sciences Library, and Associate Professor of Medical Librarianship at Temple University.

Biomedical Engineering

Major emphasis is placed on direct collaboration between BEIB professional staff and intramural researchers in the conduct of biomedical research and development programs. In addition, individual improvement is promoted through an education and training program to further

enhance the Branch's capabilities and effectiveness. BEIB has now gained a reputation as a national focal point for engineering competence and authority in biomedicine.

The Instrument Fabrication and Systems Maintenance Sections achieved unprecedented peaks in productivity during FY 1968. These sections performed 11,550 assignments during the year at a value of \$1,026,000--an increase of 5 percent in jobs and 11.3 percent in dollars over the previous annual high, reached in FY 1967.

Branch professional staff have been involved in approximately 400 research and development tasks. The year has seen especially noteworthy original contributions in the areas of artificial organs, materials, laser technology, mechanization, automation, physiological monitoring, patient care, and physiological systems analysis.

A modest program has been initiated for more economic use of scientific equipment. Experience to date shows growing acceptance of the concept by the NIH community.

D. Problems

Construction

Progress of the facilities design and construction program continues to be hindered by a number of problems. Specific programs (NIH Animal Center, Phases IA and II, Building 31 Multilevel Parking, etc.) have not progressed on schedule. In some cases, time extensions of the design phase have seriously delayed the start of the construction of the project and the eventual beneficial occupancy of the facility by the client program. In other instances, programs have been delayed as early as the POR stage or prior to the design phase. Typically, the reasons for these time delays in the design program may be classified as (1) funding problems, and (2) reviewing by groups outside NIH.

The time required for obtaining approvals from numerous outside groups, such as PBS, Bureau of the Budget, Fine Arts Commission, NCPC, and the Maryland-National Capital Park and Planning Commission, has slowed the progress of NIH construction programs. Another problem is that these groups are physically located at a distance from NIH and have no immediate commitment to NIH programs and little reason, from their viewpoint, to hasten the progress of construction projects. However, the new reorganization within the Department, including decentralization of some approvals, may help to improve this situation since some decisions can now be made at the NIH level. The reorganization may also lead to development of an improved, more direct system of construction control.

Delays during the construction period are usually due to delays in submission, approval, procurement, and delivery of specialized items of equipment, and failure by the contractor to properly schedule and coordinate his work. Overriding defense priorities have delayed manufacture and delivery of some items of equipment, particularly electrical items.

The lack of sufficient personnel and increased workload in the Design Division of PBS have seriously extended contemplated review periods and suspended progress. Decentralization of design authority to the GSA Regional Offices may improve the design schedules. The assignment of aggressive project coordinators at the PBS has improved this situation considerably.

Program Planning

The difficulty of coordinating service needs with I/D demands continues to be a major operating problem in this Division. The critical timing in the fiscal cycle precludes us from preparing a budget based on the estimated needs of the Institutes. This problem is complicated by legislative changes in I/D budgets which occur too late to incorporate in a service organization's plans. During FY 1968 the Director of DRS met with the Scientific Directorate of a major Institute to explore means of solving this problem. The response was enthusiastic and similar meetings will be held at 6-month intervals in the future. While the eventual success of these efforts cannot be precisely determined, it is planned to expand this concept to other I/D's during FY 1969.

Staffing for Key Positions

The recruitment difficulties prevalent throughout NIH continue to plague the Division of Research Services. This problem is intensified in an organization like DRS, where research understandably has lower priority than services. The Division continues to work with the Personnel Management Branch to raise the image of professional personnel in service organizations and improve the competitive position of the Division of Research Services for engineers, veterinarians, photographers, librarians, etc.

DIVISION OF RESEARCH SERVICES

Summary of Branch Activities

July 1, 1967, through June 30, 1968

RESEARCH FACILITIES PLANNING BRANCH

Howard M. Biggs
Branch Chief

I. SUMMARY

Design and construction associated with the expansion of NIH facilities continued at a record pace in FY 1968. The current RFPB program includes more than 20 projects in various stages of planning, design, or construction, having a total cost in excess of \$100 million. Seven projects were under construction during the year, and one was completed--the Gerontology Research Center, a 200,000+ square foot laboratory building, located on the Baltimore City Hospitals grounds. On the NIH reservation in Bethesda, major expansion of the utilities distribution system disrupted many roads and parking areas with some personal inconveniences. The major part of this work is now finished. The design of several projects, including two multilevel parking facilities, is nearly complete and these projects should be under construction next year. Budgetary restriction severely reduced our Development Section program; however, a limited number of design guidelines and material studies were completed for use by both NIH and other medical research institutions.

Favorable working relations with representatives of the Public Buildings Service (PBS) of the General Services Administration (GSA) in both the Central and Regional Offices continue to be essential to the success of the NIH construction program. Constant effort is being made to improve and strengthen these relationships. At the present time GSA is utilizing Architect/Engineer personnel for the detailed inspection of construction on the majority of NIH projects. These engineers work directly under the supervision of the PBS Region 3 Project Manager, and the arrangement has proven to be reasonably satisfactory to date.

GSA has recently adopted a design decentralization policy which places major design supervision responsibility on its regional offices. Authority for supervision of design of NIH projects has thus been delegated to Region 2 in New York (for Puerto Rican projects), Region 3 in Washington, D. C. (for D. C., Maryland, and Virginia projects), and Region 4 (for North Carolina projects). Region 3 has a limited professional staff which will require augmentation to effect an adequate program of design supervision. Our experience with this new delegation of authority is too limited for any further appraisal at this time.

The reviews and appraisals of proposed NIH facilities by other agencies such as GSA, the National Capital Planning Commission (NCPC), The Commission of Fine Arts (CFA), and the Maryland-National Capital Park and Planning Commission (MNCPPC) continue to extend the time for approval of projects. Design schedules for some facilities (Warehouse, NIMH Child Research Center,

etc.) have been extended through the implementation of studies associated with estimated budget deficits, master site planning, reservation parking, and other specific problems.

Communications between NIH personnel and those of the NCPC, the MNCCPC, the Washington Metropolitan Area Transit Authority (WMATA), and the Washington Suburban Transit Authority (WSTA) have improved steadily. RFPB has been able, through diligent effort, to establish a good rapport with these agencies. Negotiations for additional sanitary sewer capacity were amicably completed with the Washington Suburban Sanitary Commission (WSSC) in October 1967.

II. BRANCH PROGRAMS

A. Objectives

The major objective of RFPB is coordinating the planning and construction of new facilities on the NIH reservation and at its field stations. A secondary objective is providing development engineering services and technical assistance where special problems in design or construction are encountered.

B. Current Programs

The Design Section is primarily responsible for assuring that new construction provides for the program needs of NIH research scientists. A staff of professional engineers renders limited consulting service and provides coordination between contract architects, PBS (GSA), NIH research staff members for whom facilities are being provided, and other concerned branches of the Division of Research Services.

The Construction Section provides close technical control over new facilities for NIH during the construction phase. A staff of management engineers maintains surveillance during construction to determine that the facility is built according to plans and specifications, with particular emphasis on those aspects peculiar to NIH requirements.

The Development Section program is one of technical assistance and is directed toward improving the functional aspects of facilities presently under design, as well as contributing standards, recommendations, and solutions to operational problems encountered in existing NIH facilities.

Members of the RFPB staff are frequently called upon to confer with visiting research scientists and engineers on current concepts, techniques, and practices in the design and construction of biomedical research facilities. These visitors represent a broad spectrum of national and international medical research activities, both government and private.

C. Progress and Accomplishments (for a summary of all design and construction projects, see attached Tables I and II, respectively)

Multilevel Parking Facility for NCI-NIMH/NINDB Buildings

Planning funds for this project to provide a multilevel parking structure for 825 cars were appropriated in FY 1966. The POR for this facility was forwarded in March 1966, through channels, to the BOB. In September 1966, the BOB approved the POR after requesting that NIH make a comprehensive study of various aspects of parking, including methods of operating a multilevel parking garage. This study was completed and a report forwarded, through channels, to the BOB in April 1967. In November 1966, GSA negotiated a design contract with the A/E firm which had designed the NCI-NIMH/NINDB Building complex. Conceptual pre-diagrammatic sketches were submitted to GSA in March 1967. The diagrammatic sketches were approved on July 11, 1967. The tentative sketches were approved on November 13, 1967, and the intermediate working drawings were approved on April 8, 1968. Complete working drawings are scheduled for submission on June 3, 1968, and final working drawings on July 10, 1968.

It is estimated that the project will be advertised for construction bids in August 1968 and that construction will start in October 1968.

NIH Animal Center, Phase IA

This project includes a general laboratory building, animal behavior laboratory, and waterfowl habitat for the NIMH; and a primate building for Laboratory Aids Branch, DRS. After approval of revised tentative sketches in August 1965, this project was delayed by the A/E's requests, first, for an additional fee and later, for the termination of his contract. Each of these requests was denied by GSA. Upon official notification in December 1965 to proceed with design, the A/E resumed work. Intermediate working drawings were received by GSA in April 1966. However, the GSA cost estimate, based on the intermediate working drawing submission, exceeded available funds by \$178,000. NIH, GSA, and the A/E decided that construction costs could be substantially reduced by relocating the Primate Building. Since this requirement constituted a change in scope of the A/E's contract, the A/E requested an additional fee. At this time the design program was further delayed while the NIH request for \$25,000 additional planning funds was approved by the BOB and the funds transferred to GSA. The A/E resumed work in October 1967 and submitted complete working drawings in late January 1968. The design of this project should be completed in late FY 1968. PHS deferred construction of this project until FY 1969.

NIH Animal Center, Phase II

This project includes an agricultural management building, animal production facility, a third residence, incinerator, and necessary supporting utilities and grounds improvements. The POR was approved by NIH and forwarded, through channels, to the BOB in November 1965. The BOB delayed approval of the POR and deferred action on a request for apportionment of

the planning funds pending receipt and evaluation of additional justification for the project. Late in April 1967, the BOB gave informal approval to proceed with this project. The POR was revised in accordance with BOB approval and forwarded to GSA in December 1967. A design contract was negotiated by GSA, Region 3, in March 1968 with Lucius R. White, Jr. and Edward C. White in a joint-venture with Sanders & Thomas. Design should be completed in the fourth quarter of FY 1969, and construction should start in the first quarter of FY 1970.

Multilevel Parking Facility for Building 31

This \$1,600,000 project is for a 650-car parking garage to serve the occupants of the new wing on Building 31. The building is being designed by a joint-venture of Keyes, Lethbridge & Condon and Cochran, Stephenson & Donkervoet, the same firm which designed Building 31. The diagrammatic sketches were submitted by the A/E in June 1967. The project was approved by The Commission of Fine Arts in June 1967 and by the National Capital Planning Commission in July 1967. The NIH review comments on this submission were transmitted to GSA in August 1967 and the diagrammatic sketches formally approved by GSA in September. The A/E completed the tentative sketches and submitted them in November 1967. The NIH comments were forwarded to GSA in December 1967; however, the GSA review indicated a \$795,000 deficit in the project cost. Preliminary soil boring tests which were completed in January 1968 also indicated that, because of underground water, extensive redesign might be necessary. GSA suggested a major reduction in the size of the building to offset these two problems (the budget deficit and the costly foundation design). In February 1968, RFPB strongly recommended that PBS explore in greater detail these two problems before directing the A/E to take such drastic action. The extent of the groundwater problem was greatly reduced at a meeting in April 1968 and in subsequent correspondence, but a major funding deficit still remains.

Currently, the A/E is revising his construction cost estimate and preparing engineering recommendations. RFPB feels that some reduction in the size of the garage may be required. The future design and construction schedule is indeterminate pending the resolution of the major funding deficit.

NINDB/NICHD Research Facility, Puerto Rico

The selected A/E for this design project is Isadore & Zachary Rosenfield, Fred S. Dubin & Associates, and Efrain E. Perez-Chanis, who received the notice to proceed with the design in May 1966. The diagrammatic sketches were submitted in August 1966. They were not approved at that time due to an estimated budget deficit of \$187,000. Revised diagrammatic sketches were resubmitted in December 1966 and were approved by GSA in January 1967.

At the completion of FY 1967, the project's estimated construction cost was over its \$1,972,000 budget by \$300,000 due to a projected 14 percent per year cost escalation in San Juan, Puerto Rico. On July 12, 1967, the Director, DRS, ordered the size of the building reduced to bring the project's cost within the existing budget. After careful reviews and consultations with the two client institutes, RFPB forwarded a list of

research space reductions to PBS in August 1967. At a subsequent GSA-NIH-A/E meeting in September 1967, it was agreed to reduce the size of the planned building rather than start a complete redesign. (In early January responsibility for design supervision of the project was transferred from the Central Office of GSA to Region 2 of GSA.) The revised tentative sketches were submitted by the A/E in February 1968 and approved by NIH in March 1968. GSA formally approved the revised tentative sketches in April 1968. Currently, the A/E is preparing the intermediate working drawings which are scheduled for completion in June 1968. The complete working drawings are scheduled for completion by October 1968. Construction should start in January 1969, and beneficial occupancy should occur in the late summer of 1970.

NINDB-NICHD Experimental Facility, Sabana Seca, Puerto Rico

This project is an experimental animal compound to be built on land declared surplus by the U. S. Navy in Sabana Seca, Puerto Rico. The final POR was forwarded from RFPB to DRS on July 11, 1967. After reviewing the project, the Bureau of the Budget apportioned the requested \$200,000 for funding in September 1967. The Caribbean Division, Naval Facilities Engineering Command in San Juan, Puerto Rico, agreed to design the project on an "in-house" basis. In January 1968, an agreement for design and construction services was formally accepted by the Caribbean Division, Naval Facilities Engineering Command. Design has moved very rapidly since then. The 30 percent drawings were received in March 1968; the NIH review and approval were also completed in March 1968. The final drawings will be reviewed by NIH in June 1968. A construction contract for the project should be awarded in July 1968 and the construction completed in December 1968.

Combined Service Facility and Warehouse

Notice to proceed with the design of the Phase I Warehouse was given to the selected A/E firm by GSA in May 1965. In the diagrammatic submission of June 1965, the A/E's construction cost estimate was \$120,000 higher than the \$670,000 sum available for the award of a construction contract. However, GSA estimated at this stage that the facility could be constructed within available funds. Because GSA failed to give the A/E a notice to proceed with the development of a master plan for the warehouse area until October 1965, tentative sketches were not received until December 1965. The A/E's cost estimate at the tentative stage was \$1,099,536, approximately \$430,000 above the funds available for the construction contract award. Numerous studies were made by RFPB, GSA, and the A/E in an effort to reduce the cost of the project. All work on the project was deferred in January 1966, pending completion of the Master Site Plan for the southern portion of the NIH reservation, the Materials Handling Study, and the Incinerator Study. A new POR has now been prepared for the Phase I Warehouse and the Combined Service Facility to be accomplished as a single project. Approval by NIH of this POR is anticipated in July 1968.

Child Research Center (NIMH)

The original design for this facility was stopped at the completion of tentative sketches. In November 1965, progress beyond this stage was delayed pending a resolution to the community-sponsored recommendations for the extension of Woodmont Avenue through a portion of the NIH reservation to Wisconsin Avenue. This extension necessitated a new site for the CRC facility. Accordingly, in July 1966, NIH requested GSA to proceed with the design of the Center on a site in the southwest corner of the NIH reservation. Negotiations between the A/E firm, Johannes & Murray & Associates, and GSA delayed the initiation of the new design contract until December 1966. A revised site plan was submitted by the A/E in January 1967. Significant delays were incurred in obtaining the National Capital Planning Commission's approval of the site layout plan. The plan was finally accepted and the design should be completed in November 1968. In April 1967, at the request of GSA, DHEW reluctantly agreed to budget for construction funds for the project which originally were in a GSA appropriation. The funds were not provided in the FY 1969 DHEW program, but may be requested in the supplemental FY 1969 program. A year's delay could result if the funds are not provided in the FY 1969 budget.

NICHD Research Facility

The design of this \$9,650,000 research facility began early in FY 1968. The architectural firm of The Architects Collaborative, Cambridge, Mass., was recommended by DHEW in the spring of 1967 and the formal negotiations were successfully concluded in August 1967. The A/E was given the notice to proceed in September 1967. The firm submitted their diagrammatic sketches in January 1968. The NIH approval of the drawings occurred in February 1968; the formal GSA approval in March 1968. The project has been approved by NCPC and FAC. The tentative drawing submission is scheduled for June 1968. The design should be completed in April 1969; the beneficial occupancy is planned for August 1971.

Master Utilities Extension

This program is divided into two major phases: Phase I, which includes extension and expansion of utility systems required to supply those new facilities under construction, or recently completed; and Phase II, which will provide utilities for the remainder of the proposed buildings. The estimated cost for Phase I planning and construction is \$9,850,000. One part of the Phase I work was accelerated in order to meet the immediate needs of Buildings 12A and 29A. This work, Phase IA, was completed in January 1966. Other portions of the Phase I program have also been accelerated in order to provide additional steam and refrigeration capacity required for the construction program. The Ninth Refrigeration Increment installed in Building 11C was completed this year. Construction on the new chilled water plant, Building 34, which will furnish chilled water for Buildings 35, 36, 37, as well as others, was started in January 1967 and is proceeding on schedule. A construction contract for the 4th boiler and

the conversion of the chilled water system to year-round operation was awarded to The W. G. Cornell Company in September of 1967 and should be complete by December 1968. Construction of a new NIH/PEPCO joint-use substation was begun by PEPCO in May 1968. A contract for the NIH equipment was awarded in June 1968, and work should be completed by August 1969. This will complete all Phase I construction.

Current estimates for Phase II work indicate a total estimated cost of approximately \$5,788,000. This project will provide utility services to all new buildings including the Fogarty Center, OAM Combined Service Facility, the NICHD Building, NLM Extension, the Child Research Center, etc. The POR for this project should be ready for submission, through channels, early in FY 1969.

National Environmental Health Sciences Center (NEHSC)

Planning funds for this project were appropriated in FY 1961 and FY 1965. In August 1966, responsibility for the planning, design and construction of the NEHSC was transferred to NIH. These facilities, as well as the National Center for Air Pollution Control, will be constructed on a portion of the 509-acre site located at Research Triangle Park, North Carolina. The POR for the Master Site Plan of the 509-acre site was prepared by the Division of Buildings and Facilities, OSG, PHS. In May 1967, PHS forwarded this POR, through channels, to the BOB for approval. BOB approved the Master Site Plan POR in February 1968. The award of an A/E contract for the Master Site Plan is anticipated in June 1968, and the Master Plan should be completed by July 1969. A POR for permanent facilities for NEHSC should be completed concurrently with the Master Plan. Construction of NEHSC is scheduled to start in the first quarter of FY 1972.

John E. Fogarty International Center for Advanced Study in the Health Sciences

\$500,000 was appropriated in FY 1968 for planning the Fogarty Center. The POR was begun in October 1967 and submitted in April 1968 to the Director, NIH, for approval and transmittal to the BOB for apportionment of the planning funds. \$6,475,000 is being requested in the FY 1970 budget for the construction of the project including the extension of the master utilities and multilevel parking.

Additional Multilevel Parking Facility for Building 31

Planning funds for this project are included in the FY 1968 budget. A first draft of the POR was prepared early in 1968. The final draft of the POR was completed and distributed in May 1968. It is anticipated that a design contract for the project could be awarded by October 1968.

Master Site Plan for Southern Portion of the NIH Reservation and Tunnel Feasibility Study

This study, initiated in late FY 1966 on the recommendations of the NCPG, provides more intensive planning for development of the southern portion

of the NIH reservation. Specific problems associated with the site selection for the Warehouse Facility and warehouse operation were investigated by the consultant A/E firm of Smith Haines Lundberg and Waehler. In July 1967 the plan was approved by the National Capital Planning Commission. The final report and study were submitted by the consultant in February 1968.

General Office Building Extension, Building 31C

This project was authorized in FY 1962 with an appropriation of \$700,000 in planning funds. The complete working drawings were submitted in August 1965 and approved by GSA in October 1965. At this point, it was decided to incorporate a portion of the required utilities construction with this project in order to insure timely completion for occupancy and to avoid conflicts during construction. Final working drawings of the building and related utilities were completed in December 1965 and March 1966, respectively. The project was advertised in May 1966, and construction bids were opened in July 1966. However, because of ambiguities in the construction documents, as interpreted by the GAO, GSA rejected all bids for the project. Accordingly, the project was readvertised, and in December 1966 the Norair Engineering Corporation was awarded a construction contract totaling \$5,844,000. Construction started in January 1967 under unfavorable weather conditions which slowed up initial work. Subsequent progress has, in general, been satisfactory; however, there have been some intermediate delays. Construction was 70 percent complete at the end of FY 1968, and the estimated completion date is now December 31, 1968.

NCI-NIMH/NINDB Cafeteria, Buildings 35, 36, and 37

The construction contract for this building complex was awarded August 27, 1965, to the Blake Construction Company at a cost of \$16,782,000, which includes the contractor's base bid of \$14,728,000 and alternates valued at \$2,054,000. The complex includes a six-story structure and basement for the NCI, a five-story structure and basement for NIMH/NINDB, and a one-story Cafeteria with basement. The construction contract allows 26 months for completion. Initial construction progress was excellent. However, a serious dispute over the poor quality of work on the Cafeteria roof delayed construction on this building approximately one year, and disputes over special equipment items have delayed completion of the laboratory building. Construction work on the project was essentially completed in FY 1967, but beneficial occupancy will be delayed several months.

Gerontology Research Center, Baltimore, Maryland

Located on the grounds of the Baltimore City Hospitals, adjacent to the main hospital building, this four-story structure with a two-story mechanical wing is being constructed by John McShain, Incorporated, at a contract cost of \$6,989,000. The construction contract was awarded on October 31, 1965. Hindered by inclement weather during its initial construction stages and delays in approval and delivery of casework and environmental chambers, final completion was delayed about eight months. Gerontology Research Center personnel began occupancy of the building in February 1968.

Development Projects

Program studies, the majority of which are of short duration, are reported and distributed internally to interested NIH organizations and/or published in trade journals. Requests from extramural activities for available information are also filled. Limited research contracts continue to be an effective means for improving the quality of work and conserving manpower and money. Such contracts also increase program flexibility and provide detailed specialization where required.

Collaborative Projects

Improving animal care facilities (in collaboration with the Laboratory Aids Branch).

The vital importance of laboratory animals to health research has accentuated the need for better quality animals. In recognition of this need, a research and development program to improve animal care and facilities has been in progress for several years. The studies include: (a) the development of caging systems, particularly for the NIH Animal Center, Phase IA and Phase II; and (b) the development of the automated equipment and care procedures with emphasis on watering, feeding, and cage cleaning techniques.

RFPB also provides technical assistance and advice to other NIH groups in preparing design guidelines, criteria, specifications, and standards for equipment and facilities.

As a means of stimulating new approaches and introducing new concepts, several visits to other laboratory and animal facilities were made. Information from private institutions, as well as other government facilities, has served to foster novel ideas and solutions to operational, design, and construction problems here at the NIH.

Informational Reports

1. A Study of One-Way Mirrors
2. Cost Data for Partition Walls
3. Laboratory Furniture and Equipment,
Installation and Construction
4. Waste Piping Materials
5. Economic Analysis of Fume Hood Operation

D. Problems

Progress of the facilities design and construction program continues to be hindered by a number of problems. Specific programs (NIH Animal Center, Phases IA and II, Building 31 Multilevel Parking, etc.) have not progressed on schedule as planned. In some cases, time extensions of the design phase have seriously delayed the start of the construction of the project and the eventual beneficial occupancy of the facility by the client program. In other instances, programs have been delayed as early as the POR stage or prior to the design phase. Typically, the reasons for these time delays in the design program may be classified as (1) unrealistic time schedules,

(2) funding, and (3) reviewing by groups outside PHS. Delays during the construction period are usually due to delays in submission, approval, procurement and delivery of specialized items of equipment, and failure by the contractor to properly schedule and coordinate his work. Overriding defense priorities have delayed manufacture and delivery of some items of equipment, particularly electrical items (switchgear, controls, etc.).

Remedial action has been taken wherever possible. RFPB has encouraged the establishment of more realistic review periods in design contracts. The lack of sufficient personnel and increased workload in the Design Division of PBS have seriously extended contemplated review periods and suspended progress. Decentralization of design authority to the GSA Regional Offices may improve the design schedules; however, some additional orientation problems are anticipated. Representatives of both DRS and RFPB have brought these scheduling problems to the attention of responsible GSA officials in frequent attempts to expedite design progress. The assignment of aggressive project coordinators at the PBS has improved this situation considerably.

Some examples of major design delays in specific program areas are as follows:

1. Insufficient funds to adequately design Phase IA of the NIH Animal Center has delayed this project from April 1966 to FY 1969.
2. The design program of the NIMH Child Research Center has experienced extensive delays due to the pressure of community groups (MNCPPC and NCPC) in connection with the proposed siting.
3. The Phase II design program of the NIH Animal Center was delayed at the POR stage for more than 18 months pending the review of the initial POR by the BOB. An additional six months was required to revise the POR in accordance with the BOB budgetary restrictions.
4. The Warehouse Extension project has been deferred for more than two years pending the completion of studies for NIH related to siting and materials handling.
5. Delays in Phase II, MUE project due to deferment of funding by BOB.
6. Resolution of differences in the GSA and A/E cost estimates has delayed design progress on the Building 31 MLP facility for more than six months.

Some examples of major delays in the construction program are as follows:

1. Contractor's refusal to accept GSA direction to remove and replace the Cafeteria roof delayed work on this building over 12 months.

2. Resolution of discrepancies in painting of casework delayed installation and completion of this work several months on both the NCI-NIMH/NINDB Buildings and the Gerontology Research Center.
3. Contractor's failure to promptly schedule, submit, and order electrical switchgear delayed completion of the new Chiller Plant two months.
4. On the NCI-NIMH/NINDB Buildings the contractor's refusal to comply with contract requirements for prequalification of manufacturers of the environmental chambers and cage washing equipment required GSA to procure these items on a separate basis. This will result in an estimated delay of nine months in supplying these services and facilities to the buildings.

RFPB is continuing to pursue these problems to alleviate the causes.

PBS, which has direct responsibility for construction contract administration, continues to encounter difficulty in hiring and retaining competent personnel for construction supervision and inspection. Current A/E contracts for design of NIH facilities include an optional provision for supervision of the construction by the A/E, under the direction of the PBS Project Manager, when PBS personnel are not available.

E. Program Plans

Pending reorganization plans for engineering resources in DRS will have some effect on RFPB program plans. In any case, the ongoing construction program will continue to require careful planning, coordination, and cooperation to avoid interruption and interference with NIH research activities. In addition, major effort is required to resolve the continuing problem of program delays and assure timely completion of facilities.

The development program will continue to place strong emphasis on the design-support function for the NIH facilities planning, design, and construction program. Areas of investigation presently being studied in depth are as follows:

1. Specification for Cold and Constant Temperature Rooms
2. Specification for Cage and Rack Washers (ESB)*
3. Specification for Conveyor-Type Cage Washers (ESB)*
4. Laboratory Sealants
5. Water Still Specification
6. Use of Disposables (Glassware, etc.)
7. Ventilation Standards (ESB)*
8. Electromagnetic Shielding
9. Air Balancing
10. Cathodic Protection

*Denotes collaborating organization.

TABLE I - RFPE - FY 1968 Program of Authorized Design Projects

Project	Design Completion Date	Construction Completion Date	Construction Cost*	Planning Cost	Total Project Cost	A/E Designer
NCI-NIMH/NINDB Multi- level Parking Facility	7/68	11/69	\$ 1,985,000	\$ 125,000	\$2,110,000	SH & GA, Inc.**
NIH Animal Center Phase IA	6/68	2/70	1,325,000	125,000	1,450,000	Heery & Heery
NIH Animal Center Phase II	6/69	6/71	4,822,000	440,000	5,262,000	White & White with Sanders & Thomas
Multilevel Parking Facility, Bldg. 31	1/69	4/70	1,505,000	95,000	1,600,000	K, L, & C and C, G, & Van A**
NINDB-NICHD Research Facility, P.R.	10/68	7/70	2,172,000	148,000	2,320,000	R, D, and C**
Sabana Seca Facility Puerto Rico	6/68	12/68	188,140	11,860	200,000	Navy, San Juan, P.R.
Combined Service Facility & Warehouse	9/69	4/71	3,523,500	256,500	3,780,000	Not selected
Child Research Center (NIMH)	11/68	5/71	1,285,000	156,000	1,441,000	J & M**
NICHD Research Facility	4/69	8/71	9,640,000	850,000	10,490,000	The Architects Collaborative

Project	Design Completion Date	Construction Completion Date	Construction Cost*	Planning Cost	Total Project Cost	A/E Designer
Master Util. Phase I	9/67	12/68	\$ 9,341,600	\$ 522,000	\$ 9,856,600	HDNA**
National Environmental Health Sciences Center, North Carolina	5/71	9/74	37,860,000	3,420,000	41,280,000	Not selected
John E. Fogarty Center	1/70	12/71	5,880,000	500,000	7,000,000	Not selected
Additional Multi- level Parking for Building 31	6/69	7/70	1,410,000	100,000	1,510,000	Not selected
Master Site Plan for Southern Portion of the NIH Reservation & Tunnel Feasibility Study	2/68	N.A.	N.A.	21,000	N.A.	SHLW**

Footnotes:

* Includes construction contract, contingencies, and other construction costs.

** SH & GA, Inc. - Smith, Hinchman & Grylls Associates, Inc.

K, L, & C - Keyes Lethbridge & Condon - C, G, & Van A. - Carroll, Grisdale, & Van Alen

R, D, & C - Isadore and Zachary Rosenfield, Fred S. Dubin Associates, and Efraim E. Perez-Chanis

J & M

- Johannes & Murray & Associates

HDNA

- H. D. Nottingham & Associates

SHLW

- Smith Haines Lundberg & Wachler

N.A.

- Not applicable

TABLE II
NEW CONSTRUCTION - FY 1968

Project	Design Completion (Date)	Contract Award (Date)	Construction Schedule (Months)	Estimated Completion (Date)	Contract Overrun (Months)	Contract Amount *	Contractor
NCT-NIMH/NINDB Cafeteria <u>A/</u> Buildings 35, 36, and 37	4/65	9/18/65	26	5/31/68	8	\$16,782,000	Blake Constr. Co., Inc.
Gerontology Building <u>B/</u> Baltimore, Maryland	5/65	10/31/65	23	2/5/68	5	\$ 6,989,000	John McShain, Inc.
MUE-IB, Bldg. 34 & <u>C/</u> Misc. Outside Services	9/66	1/13/67	20	9/13/68	-	\$ 4,643,900	Norair Engr. Corp.
MUE-IB, Bldg. 11-C, 9th <u>C/</u> Refrigeration Increment	5/66	8/15/66	11	7/15/67	1	\$ 740,000	John C. Grim- berg Co.
General Office Building <u>D/</u> Extension, Building 31C	1/66	12/22/66	22	1/2/69	-	\$ 5,844,000	Norair Engr. Corp.
MUE-IB, 4th Boiler & <u>C/</u> Year-Round Air Conditioning	4/67	8/3/67	16	12/1/68	-	\$ 765,000	W. G. Cornell Co. of Wash., Inc.
MUE-IB Substation Equip. <u>C/</u> and Utilities	12/67	6/15/68 ^{1/}	13	7/20/69 ^{1/}	-	\$ 359,150 ^{2/}	

Architect/Engineers

A/ Smith, Hinchman & Grylls Associates, Inc.

B/ Cochran, Stephenson & Donkervoet and Lucius White, Clay & White

C/ H. D. Nottingham & Associates

D/ Keyes, Lethbridge & Condon and Carroll, Grisdale & Van Alen

1/ Approximate dates - No contract award has been made

2/ Low bid with all alternates

* Does not include contingencies, supervision, or planning

DIVISION OF RESEARCH SERVICES

Summary of Branch Activities

July 1, 1967, through June 30, 1968

PLANT ENGINEERING BRANCH

R. R. Holliday, Chief

I. SUMMARY

During FY 1968, the Plant Engineering Branch met all service demands with a personnel increase of only 7 percent, or 35 positions (as of May 1, 1968). Twenty-eight of these were added to the staff of the Maintenance Engineering Section to operate and maintain the utility systems of new buildings, with the remaining seven assigned to other supporting functions.

Three major construction projects were carried to virtual completion during FY 1968. The projects are the NCI Virus Isolation Building, located southwest of the NIM, the Library and Cafeteria additions to the south side of the Clinical Center, and the two-story addition to Wing D, south side of the Clinical Center. The total cost of these projects approximates \$6 million.

Efficiency of boiler operation in the central power plant was increased by about 4 percent. Studies of other utility systems were inaugurated in an effort to improve operations and reduce costs.

II. BRANCH PROGRAMS

A. Objectives

The mission of the Plant Engineering Branch is to provide responsive support to the medical research mission of the National Institutes of Health by fulfilling, as expeditiously and as economically as possible, the functions described below.

B. Current Programs

Operation and Maintenance: Consists of operating and maintaining the NIH physical, mechanical, electrical, architectural, and landscaping facilities.

Engineering: Consists of developing and preparing plans and specifications for repairs, alterations, and improvements to NIH facilities; administering and inspecting work performed by private contractors; and providing engineering services as required.

Construction: Consists of providing craft services (station labor) for altering, repairing, and improving NIH facilities.

C. Program Progress and Accomplishments

Work Performed By Station Labor: Requests for FEB services are received in the form of written work requests and by telephone. Telephone requests for

minor services such as clogged plumbing, light bulb replacement, air conditioning malfunctions, and utility leaks are received by three decentralized area maintenance units. All written requests are received by one central work reception office.

An average of 1500 telephone requests are received each week, while written orders average about 360 per week. Almost all telephone requests and about 60 percent of the written orders require little or no formal planning (plans, special material, or detailed estimates of labor). About one percent of the written orders, however, require the services of professional engineers for planning, and most of these projects are performed by private contractors rather than by station shops. No additional personnel were employed during the year for station shop activities. An examination of material expenditures for these activities indicates that gross work output remains high.

Chart I reports material expenditure trends by quarter since 1963. The dollar value of material expenditures during the year appears to be starting an upward trend over the previous year.

A good measure of the adequacy or responsiveness of the station shops service is the work in backlog. Experience has shown that an eight-week backlog will allow the most responsive service without sacrificing efficiency. Charts II and III report the backlog trend for the central craft shops since August 1965. The backlog during FY 1968 has remained level at about ten weeks, indicating that responsive service was provided.

Construction By Private Contractors: Most large jobs, estimated to require 350 or more manhours, are constructed by private contractors. Work awarded since FY 1964 has been as follows:

<u>Fiscal Year</u>	<u>No. of Contracts</u>	<u>Dollar Value</u>
1964	218	3,016,000 1/
1965	178	2,250,000
1966	152	7,735,000 2/
1967	132	2,500,000
1968	169	4,500,000 3/

- 1/ Included Building 12A (\$1,440,661)
- 2/ Included the NCI Virus Isolation Facility (\$3,188,000) and the Library and Cafeteria and Wing D Additions to Building 10 (\$2,752,000)
- 3/ These figures include work awarded through March and estimates of work scheduled to be awarded prior to July 1, 1968.

Construction for Direct Research Support

NIH Library Relocation

In 1964, \$900,000 was appropriated for the planning and construction of new library facilities for the National Institutes of Health. The POR was completed in December of 1963 and design was completed in November 1965. The construction contract was awarded in April 1966 and is complete except for minor items,

NATIONAL INSTITUTES OF HEALTH
Division of Research Services - Plant Engineering Branch

MATERIAL SUMMARY

Quarters (fiscal year)

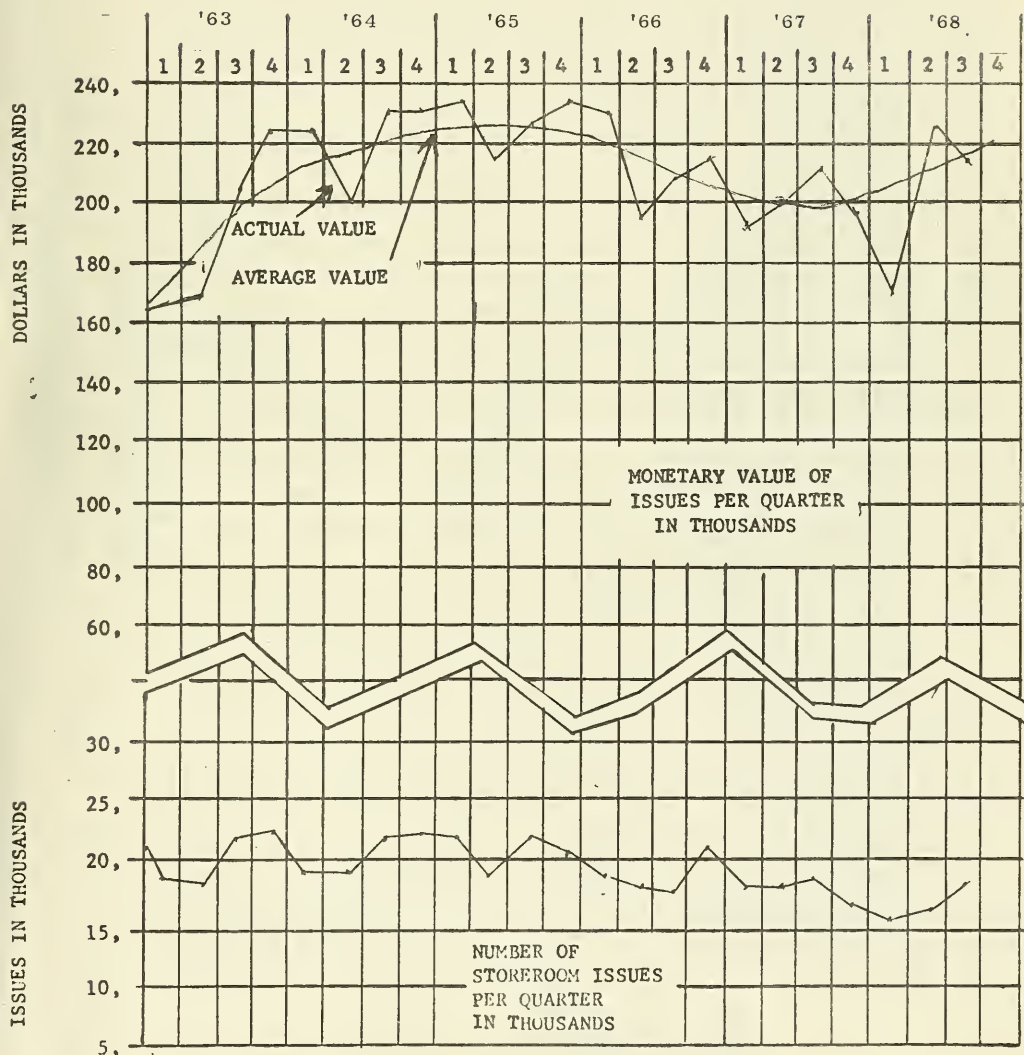


CHART I

NATIONAL INSTITUTES OF HEALTH
DIVISION OF RESEARCH SERVICES - PLANT ENGINEERING BRANCH

SHOP WORK BACKLOG SUMMARY

Reporting Period August 1965 thru December 1966

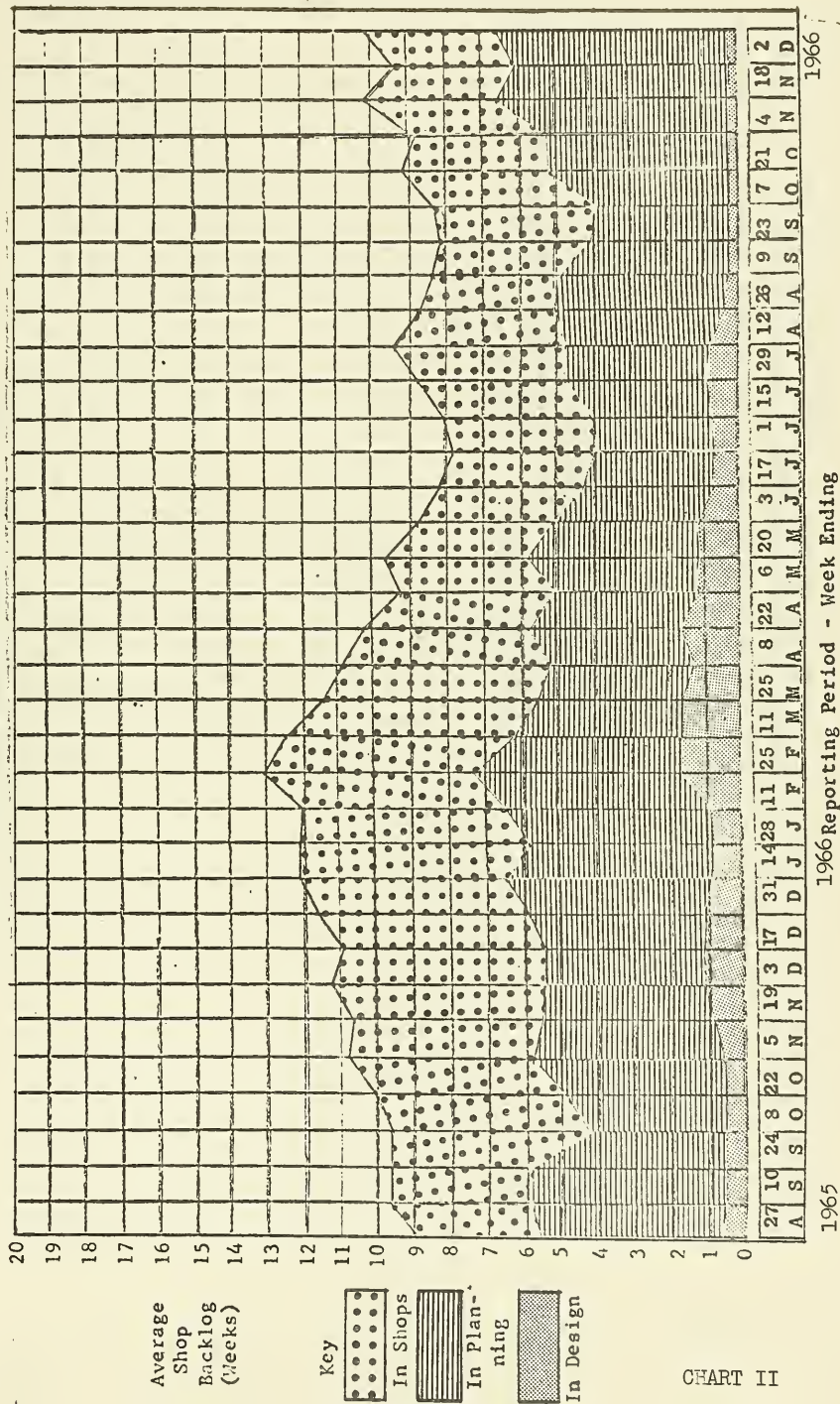


CHART II

NATIONAL INSTITUTES OF HEALTH
DIVISION OF RESEARCH SERVICES - PLANT ENGINEERING BRANCH

SHOP WORK BACKLOG SUMMARY

Reporting Period December 1966 thru March 1968

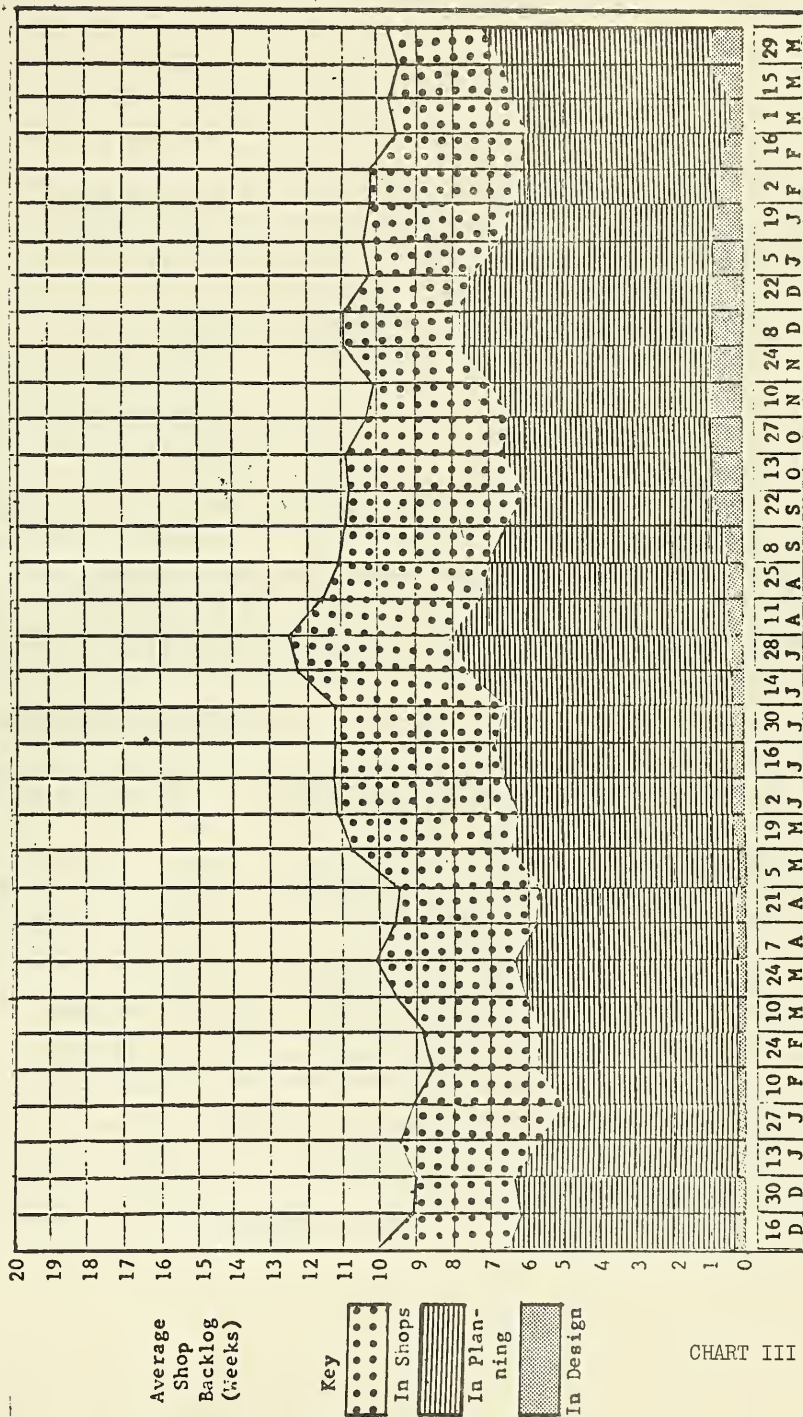


CHART III

1966 1967 1968

Reporting Period - Week Ending

with the Library being opened for use in April 1968.

Extension of Clinical Center Cafeteria

Contained in appropriations for both 1961 and 1964 was a total of \$695,000 for the extension of the Clinical Center Cafeteria facilities. Essentially this project provides for increasing the seating capacity and separating patient food preparation from employee facilities, enabling the employee food service to be operated by an outside concessionaire, leaving specialized preparation of patient diets the sole concern of the Clinical Center dietetic department. The POR was completed in February 1964 and the design contract was awarded in July 1964 with design completed in November 1965. The construction contract was awarded in April 1966 and is expected to be completed in July 1968.

Expansion of Clinical Center Facilities

In 1966, \$1,550,000 was provided for specific additions to the Clinical Center. The additions specified were a subbasement under the relocated NIH Library (\$650,000) and two floors on the south half of Wing D (\$900,000).

Both of these additions are scheduled for final completion by the end of this fiscal year with the Library space already occupied on the two top floors and the subbasement area being converted to use by the Medical Arts and Photography Branch. The Wing D Addition is substantially complete except for metal partitions and acceptance of the mechanical work in the 8th floor machine room.

Virus Isolation Facility, Building 41

Funds were provided the NCI in 1965 for the construction of a virus isolation facility which would provide an experimental research environment capable of handling all levels of hazardous work related to virus research.

Dr. Kenneth M. Endicott, Director, National Cancer Institute, NIH stated before a Subcommittee of the Committee on Appropriations, House of Representatives in February, 1965, that "The control and containment of biohazards is a newly recognized problem in cancer research. Only recently has it become apparent that certain viruses, heretofore thought to be species specific, can, in some cases, cross species lines, especially in the highly concentrated preparations (in some cases thousands of times beyond the normal state) required by laboratory experiments. This constitutes a definite hazard to personnel engaged in virus studies and to the success of their research should the materials with which they are working become contaminated".

Consequently an emergency program for construction was initiated by the NIH. A contract for design was awarded in November 1965, and the design was completed in May 1966. A construction contract in the amount of 3.2 million dollars was awarded in June 1966, and the building is scheduled for completion and beginning occupancy in July 1968.

Isotope Laboratory Addition

The 1967 Buildings and Facilities Appropriation included \$500,000 for the design and construction of an extension to the existing Isotope Laboratory, Building 21. This additional space will include laboratories for the assay of radioactive materials, calibrating radiation survey instruments and for student use in the Radioisotope Training Course. This addition will also provide for an increase in the present office space.

The POR was completed in March 1967 and design was completed during April 1968. The construction contract is scheduled to be awarded in June 1968 with completion of this facility in July 1969.

Alterations For Direct Research Support: The trend of this service can be assessed by comparing annual expenditures for station labor materials and contract work for the past four years.

Station Labor Material

<u>Fiscal Year</u>	<u>Material Expenditures (accrued)</u>
1964	\$486,200
1965	467,500
1966	500,000
1967	558,000
1968	543,000 **

Contract Expenditures (Awards)

<u>Fiscal Year</u>	<u>No. of Contracts</u>	<u>Costs</u>
1964	126	\$659,500
1965	87	330,800
1966	77	727,000
1967	68	1,136,335 *
1968	85	800,000 **

* 1967 Includes renovation of Clinical Center 5th floor library area to laboratories (\$450,000).

** Projected by estimate for 12 months. Actual expenditure for first nine months - Station Labor \$406,722; Contract \$205,000.

The above data shows that the level of services provided by station labor and by contract for alterations in direct support of research has remained fairly level during the past five years.

Engineering Design Services: During the report period, the engineering staff of the Branch conducted surveys and prepared plans and specifications for contracted work and for the more complex station labor projects. Professional services contractors were utilized as necessary, with the engineering staff directing and reviewing their efforts. The work of professional services contractors engaged by the Public Buildings Service, GSA, for the design of NIH facilities was also reviewed by this group.

This year a greater proportion of the engineering design work was performed by professional services contractors. This was largely due to late programming of fiscal year requirements by the Institutes, and restrictions imposed in the first several months of the year on contracting authority. This resulted in the major portion of the year's work being established after February 1, and the limited time remaining necessitated contracting much of the work.

A summary of the work for which design was completed during the report period follows (projected through June 1968):

<u>Type</u>	<u>No. Completed</u>	<u>Actual or Estimated Cost of Construction</u>
Professional Services Contract	16	\$2,344,000
Staff Projects for Contract Work	94	1,515,000
Staff Projects for Shop Work	85	
Engineering Studies or Surveys	24	

A few of the more important projects are listed below:

Alterations

Renovate "C" Level Areas of Library, Building 38	\$ 70,000
Prepare B2 Area of Library Addition for Medical Arts & Photography Work, Building 10	95,000
Remodel West End, 2nd and 3rd Floors, Building 10, NIMH	250,000
Modifications to Building 36, NIMH	250,000
Modifications to Building 37, NCI	900,000
Modifications to Building 5, NIAID	225,000

Plant Maintenance

Repaint Public Areas, Various Buildings	\$ 30,000
Remodel Electrical Distribution Systems, Rocky Mountain Laboratory	75,000
Install Drainage System West of Building 14A	8,500
Resurfacing of Parking Areas, Reservation	35,000

R&I and New Construction

Extension to Building 21	\$425,000
Stairwell Additions & Elevator Additions & Replacements, Buildings 2 and 3	300,000
Air Conditioning Modifications, Building 10	615,000

Joint Refuse Disposal Study: A study made by Metcalf and Eddy Engineers of Boston, Mass., has resulted in decisions to (a) build a joint-use facility to serve the incineration requirements of NIH, NNMC, and WRAMC, (b) construct this facility at the WRAMC Forest Glen Annex, and (c) have NIH act as the builder and operator of the facility. Completion of this facility is scheduled for the fall of 1970. During FY 1968 an additional study was completed by Metcalf and Eddy Engineers relative to collection and transporting methods and procedures for the various forms of NIH-generated refuse. This study

also identified new transporting equipment to be procured, and special design features required in the new Incinerator Plant.

Work Procedures, MARU, Panama Canal Zone: Formal agreements are being arranged with the Panama Canal Company for design and construction efforts required to support facility alterations, maintenance and improvements needed by MARU. Procedural arrangements between DRS and NIAID have been developed to effectively execute work requirements utilizing the Panama Canal Co., with DRS acting as the agent of the Institute.

Power Plant: During the past year the operating efficiency of the boilers has increased approximately 4 percent over previous years, with a resultant fuel saving of approximately \$22,000/year based on FY 1967 fuel usage. A number of factors, which are listed below, contributed to this:

1. Installation of shot cleaning system giving better heat transfer to preheated air. This also resulted in a manpower saving of approximately 500 manhours per year previously required to clean tubes.
2. Increased load.
3. Improved feedwater controls.
4. Steam atomizing burners.
5. Lining inside of boilers with additional insulation by the gunniting process.
6. Low sulphur fuel oil resulting in cleaner surfaces and better heat transfer.
7. Improved operating procedures.

A no-break electrical power system was installed for the boiler controls. With this system the boilers will continue to operate uninterrupted should an electrical power failure or a dip in voltage occur. The system consists basically of a bank of batteries and an inverter which continuously supplies alternating current to the boiler controls.

On February 12, 1968, an all-time steam peak of 261,000 lbs./hr. was reached in the boiler plant. This occurred with the outside temperature at about 20°F and with Buildings 36 and 37 taking a light load on the preheater coils. The buildings were maintained at about 55°F to 60°F during this period of construction.

The addition of a fourth boiler in the power plant brought the steaming capacity to 600,000 lbs./hr. Also, a new air conditioning plant brought its capacity to almost 20,000 tons, thus making it one of the largest in the country. The technical and administrative responsibility, therefore, increased, making it necessary to strengthen the supervision in the plant. The positions of Power Plant Superintendent and Assistant Superintendent

were established and filled by a professional mechanical engineer and a mechanical engineering technician. Also, because of the increased plant size and increased responsibility and plant importance, the position of Shift Superintendent was established and filled, thus allowing the Shift Head to spend full time supervising and overseeing the operation of this large, important facility.

Surveys: Many facets of the utilities systems have been studied for improved performance and appropriate action planned or placed into effect. For example: improvements in air quality in the building environments is being obtained by establishing better tests to determine whether the filter media meets performance requirements, and by replacing outdated filtration systems; oil carry-over into the central compressed air system will be reduced by improving on filters and maintenance of filters; a conveyor system being installed in the Incinerator Plant will enable more effective handling of potentially hazardous and normal wastes received in GI cans; a twice yearly schedule of engineering inspection trips has been adopted for MARU, Panama Canal Zone, and the Rocky Mountain Laboratory to identify potential plant and utility system deficiencies.

Interim Facilities, Research Triangle Park, N. C.: A second phase of interim facilities for DEHS is in the early design stage. This will include a laboratory building, an aerotoxicology building, an experimental animal building, and a central utilities plant. The structures are to be constructed with a build-lease contract, with construction expected to start approximately January 1969.

Incinerator: Formerly, fairly large quantities of scrap lumber items were delivered to the incinerator for disposal. These were bothersome to the burning crew, frequently requiring cutting and sawing before being charged into the burning chambers, and also causing considerable damage to the fire-clay brick linings. A study showed that a substantial part of the material, wooden shipping pallets, and skids, would be taken by GSA and GPO where, apparently, many of them originated. Arrangements were made to collect them for pickup. These procedures resulted in a saving estimated at \$800 to \$1000 per year, as well as reduced breakage of brick work.

Maintenance of Water Stills and Autoclaves: Several years ago, loss of skilled personnel through retirements, transfers, etc., resulted in a critical shortage of personnel skilled in the operation and maintenance of water stills and autoclaves. The quality of distilled water in the house systems was being affected, and numerous complaints were received regarding malfunctioning of autoclaves. Near the end of FY 1967, all maintenance to these kinds of equipment was centered in a trained crew especially selected for this work. During the first year of this arrangement a marked improvement was noted in the quantity and quality of distilled water available in the buildings, and the trouble calls on autoclaves were reduced to only a fraction of those formerly received.

Painting Schedules: As an economy measure, the maintenance repainting schedule for laboratories and offices was increased during the year from six to seven years, and from three to four years in nursing units of the Clinical Center.

Elevators: All of the elevators on the reservation, except those in the newest buildings still under builder's responsibility, were brought under formal preventive maintenance procedures under which PM inspections are made to uncover deficiencies, hopefully to prevent breakdowns. This does not apply to elevators in Buildings 10 and 31, which are maintained by contract.

Completion of Major Projects: Several major construction projects were carried through to completion during the year, as follows:

<u>Project</u>	<u>Accepted for Beneficial Occupancy</u>
Library Addition to Clinical Center	March 8, 1968
Cafeteria Addition to Clinical Center	Accepted for partial occupancy January 26, 1968

Laboratory Refrigerators: The first two shipments of 50 each of an improved model undercounter laboratory refrigerator were received and are carried as stock items under the shop stores system. The refrigerators are single-temperature (no freezer compartment), six-foot capacity, sized to be compatible with standard laboratory furniture and having an explosion-proof interior and other safety features.

Ultra-low Temperature Freezers: In recent years there has been a great amount of administrative confusion and technical difficulty in obtaining warranty repairs on ultra-low temperature freezers. Arrangements were worked out with the Supply Management Branch under which PEB is to be the sole contact point for requesting freezer repairs, both during and after the warranty periods. Maintenance history and cost records will be maintained to use in evaluating reliability of the various manufacturers' models.

Electrical Outlets in Corridors: In collaboration with the NIH Safety Office, standard details were developed for providing adequate load protection for electrical outlets supplying power to laboratory equipment permitted to remain in corridors.

Freezers in Building 10: The Branch assisted OD in surveying the requirements for freezer space in the Clinical Center, which resulted in a program being approved which allows a limited number of freezers to be permitted in corridors and freight elevator lobbies. Suitable space was also made available and provided with electrical power for long-term freezer storage on the third floor of Building 14A for many of the freezers which could not be accommodated in Building 10.

Organization: The Grounds Maintenance and Landscaping Section was reorganized slightly during the year. The reorganization consisted mainly of redefining functions and consolidation of the former Pavement Maintenance Unit with the Heavy Equipment Unit. A landscape architectural draftsman was hired to assist in development of master landscaping plans to be implemented when completion of major construction projects will permit. The master plans, covering both the main reservation in Bethesda and NIHAC, are expected to be completed by July 1968.

With the completion nearing for Buildings 35, 36 and 37, a satellite unit of building engineers was established under the South Buildings Unit to handle the operation and minor maintenance of utility systems in these buildings. The group operates out of quarters in Building 37 to obtain greater productivity of manpower.

NIHAC Grounds: Early in the year a shelter belt of coniferous evergreens was planted at NIHAC by contract along Elmer School and Club Hollow Roads. Several losses occurred during the winter. The plants concerned are covered by maintenance and warranty clauses of the contract and will be replaced by the contractor.

Employee-Management Relations: During FY 1967, the Washington Area Metal Trades Council, AFL-CIO was given exclusive recognition for a second bargaining unit--all wage board employees of the Shops Section. The Council previously had been recognized for the Grounds Maintenance & Landscaping Section, and a formal agreement was negotiated several years ago. Negotiations for the Shops Section agreement were completed on April 18, 1968. The Council has indicated its desire to renegotiate several sections of the Grounds Maintenance agreement, particularly those clauses dealing with training and promotions. The negotiations are expected to be completed by the end of the fiscal year.

Training: The Branch supported approximately 550 man-days of formal training in FY 1968, or roughly one man-day per employee. A total of 128 individuals, or 22 percent of the total work force, participated in the training.

In-service and interagency training accounted for 446 man-days, consisting primarily of a formal refrigeration and air conditioning course taught within the Branch, and a newly inaugurated series of courses conducted by the staff of the Grounds Maintenance and Landscaping Section. The first of these, entitled "Plant Life," is being attended by 27 individuals. Also notable are a course for first-line supervisors, conducted by a psychiatrist from NIMH, and a course conducted for the Branch by the Montgomery County Board of Education, aimed at providing basic education to prepare employees having a minimum formal education for the journeyman helper's examination.

Non-government training accounted for 110 man-days, including ICS correspondence courses, courses for professional engineers, training in refrigeration and air conditioning controls, specialized training on turf grasses, etc.

D. Problems

Incinerator: In FY 1967 new Rotoclone exhaust gas scrubbers were installed in the incinerator plant to eliminate the release of fly ash and other particles into the atmosphere. Basically, the scrubbers perform satisfactorily for their intended purpose, but major maintenance problems have arisen which were not foreseen either by the NIH staff or consultants retained to design the system. Because of the high acidity of the effluent, there has been considerable corrosion to waste lines and scrubber components, requiring replacement. Efforts are under way to determine the requirements to keep the units in operation

until the new incinerator is constructed and operational, at which time the present incinerator is to be abandoned. These problems may be typical of what may be expected under impact of the air pollution control program when applied to incinerators of similar size and design operated by state, county, and local governments, as well as by private industrial firms.

Grounds: The general condition of the grounds leaves much to be desired. The large amount of trenching and building construction, with the accompanying stock-piles of supplies, materials, and debris, has kept a major part of the campus in an "eyesore" condition for the past year. GML has expended much labor attempting to save valuable materials by transplanting trees and shrubbery from construction areas to other areas. Many more hours were spent giving special attention to large trees remaining within construction areas, in an effort to preserve these valuable assets weakened by grade and water table changes, physical abuse, and a very dry winter.

During a good part of the year, GML had to operate with a reduced supervisory staff and shortages in other categories. Under these conditions the plan, to take "first things first", resulted in having to forego the customary "polish" in undisturbed areas, the usual mark of well-kept grounds.

Uniforms: When Government-furnished uniforms first were provided for PEB wage board employees about eighteen months ago, a few employees were found to have skin sensitivities to them. At first this was believed to be caused by washing procedures but later was traced to some agent in the cloth. During FY 1968, new uniforms were obtained for employees experiencing irritation. Replacements will all be of the new type. Evidence to date indicates that the new materials do not cause skin irritation.

Safety Shoes: For several years the Branch, in cooperation with the NIH Safety Office, has been trying to establish a safety shoe program, a simple and inexpensive means for employees to buy safety shoes and be properly fitted at NIH. Several administrative difficulties have prevented going ahead with this program but interim arrangements have been made with one manufacturer to provide samples. During the past several months an appreciable number of employees have ordered safety shoes, and those received have been highly satisfactory.

Master Utility Extension Contract: During the year the project to extend underground steam and chilled water lines has required extensive trenching operations. Where the trenches have run near the older buildings, considerable problems typical of this type construction have developed. Breaks in cables supplying street lighting circuits have been almost a daily occurrence, and some street lighting circuits were out of service for extended periods of time. Other major utility interruptions were as follows:

(a) On July 28, 1967, the contractor broke an 8-inch water line located east of Building 3, which affected Buildings 3 and 21. Station forces isolated the break and pumped out the trench so the contractor could make the repair. About 4 inches of water flooded the east basement of Building 3, but no serious damage to equipment occurred.

(b) In October, the contractor broke a gas line to Building 9 while excavating the steam trench in Parking Lot IB behind Building 1. Gas service to the building was secured for one and one-half days while repairs were made.

(c) On January 30, 1968, the concrete encasement housing high voltage feeders 1, 14, 33, and 42 across an open ditch over the new steam line at the northeast corner of Building 3 collapsed. The weight of the concrete put a strain on these cables which supplied power to Buildings 3, 7, 8, 9, 12, and 16. To avoid the possibility of a cable failure which could have caused loss of power to these buildings for an extended period, power through the cables was shut off for a period of about 8 hours while the concrete encasement was removed and the strain on the cables relieved. During this time the above buildings were partially supplied with emergency power from gasoline and diesel generators. During the next two weeks the cables were replaced, one at a time, without any power outage to any of the buildings.

(d) On March 26, 1968, while excavating around the thrust block on the chilled water line east of Building 12A, the contractor broke a vent line. Quick action by Power Plant personnel in closing the 20-inch chilled water valves to this section of the line prevented a large loss of water from the chilled water system.

Personnel Levels: Some difficulties were experienced during the year in recruiting skilled personnel to fill vacancies. The problem was complicated by several "freeze" periods when new employees could not be hired. Recruiting efforts were stepped up in the third and fourth quarters, and it is expected that the year will end with most of the critical needs filled.

As of April 30, 1968, there were on board 570 employees, an increase of 31 over the 539 who were on board on July 1, 1967. During this period, 75 new personnel came on board, and 44 were lost through deaths, transfers, retirements, resignations, etc.

The comparative on-board figures, by section are as follows:

<u>July - 1967</u>	<u>May - 1968</u>
O/C 12	O/C 12
EDS 28	EDS 29
GMLS 47	GMLS 50
PCS 32	PCS 31
Constr. 13	Constr. 13
MES 234	MES 262
Shops 173	Shops 173
Total 539	Total 570
Shop Stores 21	Shop Stores 25

E. Program Plans

Operating Plans: Long- and short-range plans used to direct the day-to-day business of the Branch include: (a) operating budget and related reports; (b) daily reports from the preventive maintenance system as needed to generate the maintenance needs requiring immediate attention, and monthly and annual reports for major repair and improvement program plans; (c) weekly workload reports which reflect the estimated craft labor requirements by trade; (d) monthly workload reports which reflect the estimated engineering manpower requirements for engineering services by discipline; (e) weekly personnel status reports which report the available manpower by organizational unit resulting from personnel attrition and recruitment; and (f) monthly Shop Stores status reports.

F. Publications

A feature article prepared by a planner of the Grounds Maintenance and Landscaping Section was published in a nationally-distributed periodical:

Rosenkranz, George P.: Midwinter Weed Control--
useful practice for National Institutes of Health.
Weeds, Trees and Turf - 6: 18-19, Oct. 1967

DIVISION OF RESEARCH SERVICES

Summary of Branch Activities

July 1, 1967, through June 30, 1968

LABORATORY AIDS BRANCH

Dr. R. D. Zinn, Chief

I. SUMMARY

The Laboratory Aids Branch constitutes a basic central research resource of fundamental importance to the intramural research programs of the National Institutes of Health. Its responsibilities include producing genetically characterized research animals and animals of known microbial flora and health status; procuring, conditioning, and issuing animals obtained from outside sources; animal surgery, X-ray, and recovery; animal disease diagnosis and control; maintaining animals and collecting biological specimens; preparing bacteriologic and tissue culture media, tissue culture cells, and laboratory glassware; and providing professional services relative to animal procurement, health, care, and husbandry. Additionally, the Branch is responsible for conducting studies necessary to advancing the definition of experimental animals, their health, and optimum maintenance.

Major emphasis was placed upon data processing of production and animal issue information in order to achieve greater efficiency in the utilization of limited production facilities. Additional efforts were made to establish more meaningful communications with the Institutes and Divisions regarding their current and future requirements for experimental animals. Efforts to improve the quality of all animals furnished to intramural research programs were continued and intensified. For the first year in recent history, the rodent and rabbit production colonies experienced no major outbreaks of disease. Significant improvements in the quality of the random source dogs and cats issued were noted and are directly attributable to the lengthening of the conditioning period from 30 to 45 days.

A development of singular importance, the successful establishment of a large colony of donor dogs to furnish whole blood, has resulted in a significant reduction in the numbers of dogs required for research purposes at NIH. The furnishing of blood, coupled with improvements in the health status of conditioned random source dogs, reduced the needs for dogs by 786 animals. Projected dog issues for the year will be 3,612, the fewest number of dogs issued since FY 1960.

II. BRANCH PROGRAMS

Production of Laboratory Rodents and Rabbits

A. Objectives

To support biomedical research at NIH by providing quality rodents and rabbits of uniform genetic and health characteristics. To advance the definition of what constitutes satisfactory experimental rodents and rabbits.

B. Current Programs

1. Production Program

Major emphasis was placed on data processing of production and animal issue information in order to achieve greater efficiency in the utilization of limited production facilities. Additional efforts were made to establish more meaningful communications with the Institutes and Divisions regarding their current and future requirements for experimental animals.

2. Genetics Program

This program is designed to maintain the genetic integrity and desired features of the foundation inbred strains of mice, rats, and guinea pigs; and to support the production effort by providing genetically controlled breeding stock for the production colonies.

C. Program Progress and Accomplishments

Production and issue of rodents and rabbits was at the maximum permissible level consistent with adequate housing of animals within the limited production facilities which are available. Improvements in management and care practices resulted in a production year free of any major disease outbreak.

An intensified program of nutrition research was initiated through the addition of a staff nutritionist and the establishment of a nutrition laboratory. Efforts will continue to more specifically define the dietary requirements of the several species maintained and produced in order to eliminate the necessity for feeding a variety of vegetable supplements. Some progress was made in this regard, and all supplements have been discontinued for the mice and rat production colonies. More rigid inspection and disinfecting procedures have been continued for the supplements being fed to the guinea pig and hamster colonies.

Updating and improvements to caging systems have been continued, and new and improved caging, including those with filter tops, are under continuing evaluation.

Disposable waste receptacles are now utilized in all rat and mouse rooms. Use of these containers eliminates the necessity for having GI cans in the rooms and precludes the introduction of foreign microorganisms through improperly cleaned GI cans.

D. Problems

Existing and anticipated demands for animals in the face of limited production capacity causes real doubt about the availability of animals for research needs in the immediate future. Production facilities approved for the Animal Center under Phase II were reduced by 50 percent, and the remaining portion is still some six years away. During this same period, available laboratory space will be increased by some 40 percent.

E. Program Plans

Hopefully, the production space presently occupied by the Division of Biologics Standards in Building 14D and the production rooms occupied by the National Cancer Institute in Building 14E will be returned to the Laboratory Aids Branch for programming and utilization as rodent and rabbit production facilities. Return of this space will permit an estimated increase of 15 percent in our production capabilities. A small isolation facility for housing new rodent and rabbit foundation stocks and strains has been requested for FY 1969 at the Animal Center. This facility is urgently needed for meeting requests for establishing and producing new strains and stocks to meet specific research requirements. All incoming strains and stocks will be isolated for three generations in this facility, to preclude the introduction of diseases into our production colonies.

The installation of a new vacuum exhaust system on the Building 14A cagewash and the improvement of the existing vacuum system on the Building 14F cagewash during FY 1969 will permit a significant improvement in cage cleaning practices. When operational, these vacuum systems at the cagewashers will eliminate the practice of dumping soiled bedding from animal cages within the production rooms. This will decrease the dust level in the animal rooms and allow personnel to give more direct attention and time to the animals.

Production of Special Animals

A. Objectives

To furnish intramural research programs with laboratory animals whose associated flora and fauna is defined in some specific manner, i.e., germfree, pathogen-free, RIF-free, etc. To develop systems and methods for more efficient production and use of a greater variety of these animals.

B. Current Programs

Four strains of germfree mice and four strains of germfree rats are being produced in stainless steel and flexible plastic isolators. One additional strain of mice and three additional strains of rats were introduced into the barrier rooms during the past year. A total of five strains of mice and four strains of rats are now maintained and produced in the SPF state.

Work is continuing in an effort to establish the hamster in the germfree state. Initial work is also underway to gain experience with the germfree cat and rabbit. A modest program was undertaken during the year to establish the Hartley guinea pig in the SPF state. Our work to date has been somewhat encouraging, and 30 guinea pigs are now in the SPF state. This work will be continued and, when satisfactory procedures are established, a group of Strain 13 inbred guinea pigs will be introduced into the SPF barrier in order to provide greater health security to this strain.

C. Program Progress and Accomplishments

The flexible plastic isolators for housing the RIF-free chickens have been placed in full operation in the Building 14G facility. They have proven satisfactory, and no contamination problems have been experienced. Additional caging for rats and mice is on order, and when received and operational, will permit a higher level of utilization of the Building 14G SPF facility.

D. Problems

A further delay was experienced in getting the new RIF-free chicken facility operational at the Animal Center. Partial occupancy was achieved during the year, and full production should be achieved during FY 1969.

Success in establishing the hamster in the germfree state continues to be delayed, though ultimate success is expected. Enlarged cecum syndrome continues to be a problem with guinea pigs in both the germfree and SPF states.

E. Program Plans

Development work will be expanded to include more intensive efforts with the cat and rabbit. The work with the hamster and guinea pig will be continued. Additional strains of rats and mice will be introduced into the germfree and SPF state in order to gain production data prior to the construction and occupancy of the Phase II SPF rodent facility.

Production of Laboratory Carnivores and Canine Blood

A. Objectives

To produce laboratory cats and dogs of defined characteristics to meet intramural research requirements. To reduce the overall needs for dogs by supplying blood from a canine donor colony.

B. Current Programs

The canine blood donor colony, which was established in July 1966, has been expanded from the original 25 dogs to 113 dogs, with a production capacity of 158 units of blood per month. The laboratories which have been using blood from these animals have been enthusiastic in their acceptance of it. The current short-term objective is to expand the colony to about 200 dogs, which is equivalent to conditioning 140 dogs for issue each month. Expansion involves the addition of new dogs to the colony and replacement of those which have undesirable characteristics. The source of replacements is the breeding colony maintained at Building T-8. Dogs comprising the blood donor colony are being selected for uniformly large size, good temperament, and A negative blood group.

The original breeding colony of white hounds has been largely replaced by American foxhounds. The breeding program is confined to production and intensive selection of dogs to improve the genetic characteristics of the

colony. A significant number of the dogs produced serve as additions and replacements for the blood donor colony.

Three English foxhounds were added to the colony, and limited matings have been made. A small number of dogs of this breed are maintained as a nucleus from which to expand. Thirteen inbred beagles were also introduced into the colony.

The contract for rearing American foxhounds was renewed. The breeding level originally planned, 100 females, will be achieved in FY 1969. Production is expected to achieve 400 research dogs during the current contract year.

The cat breeding colony consists of about 30 breeding females. Cats are subject to intensive culling procedures in order to establish a high producing colony with uniform characteristics. Substantial progress has been made in attaining this goal.

C. Program Progress and Accomplishments

Blood issues will be approximately 850 units for the year (=425 dogs). The number of puppies produced is expected to be about 390, and kittens, 140.

Renovations in Building T-8 were completed this year, resulting in increased and improved personnel, laboratory, office, and storage space. The acquisition of adequate laboratory equipment and personnel this year will permit more in-depth studies to be made on the dogs and cats maintained in the colony.

D. Problems

The beagles, American and English foxhounds represent the full range of dog sizes required for research use. Production of meaningful numbers of dogs for this purpose, however, is not possible in the temporary facilities available. Likewise, the cat colony cannot be expanded. The blood donor colony can be increased to within 66 percent of its projected size.

E. Program Plans

Additional facilities have been requested in which to house the dog and cat breeding colonies and the canine blood donors. In such a facility, about 2,200 puppies could be reared yearly, and the blood equivalent of 2,500 dogs could be produced. Combined with the foxhounds expected from the contract source, such an in-house breeding and donor program would provide the NIH with 5,500 dogs annually. These facilities would also permit the rearing of 1,500 to 2,000 kittens per year.

Studies are in preparation which are designed to provide more definitive characterization of the dogs and cats reared in the colonies. Work is also in progress to determine objectively some of the environmental and psychological requirements of dogs maintained in confinement. A quality control program is being developed to insure the production and issue of normal canine blood on a continuing basis.

Quarantine and Conditioned Animals

A. Objectives

To provide intramural research programs, insofar as possible, healthy random source dogs, cats, primates, and feral animals.

B. Current Programs

The program consists of controlled quarantine and conditioning procedures including the application of clinical veterinary medicine. Preventive medicine programs and the application of sound husbandry practices constitute the core of the program. The flow of animals to the laboratories was partially interrupted twice in the report year--one period of two weeks for dogs, and a four-week period for cats--due to the failure of animal suppliers to deliver animals in requested quantities. However, at no time was any investigator totally denied research subjects. Daily populations of all species were maintained at the highest possible level, consistent with facility utilization and the availability of animals from suppliers.

C. Program Progress and Accomplishments

This is the first full report year under the conditions imposed by the Animal Welfare Act. The effects of the Act upon the conditioning program were minimal. Previously implemented procedures permitted compliance with the law without major changes or loss of function. The purchase price of dogs and cats increased significantly. The general quality of the animals and the numbers offered for sale declined slightly. Monthly morbidity and mortality figures did not change appreciably.

A full year of experience with a 45-day conditioning period for dogs and cats was completed. The health and general body condition of 45-day conditioned animals is clearly superior to previously issued 30-day conditioned animals. The conditioning programs for subhuman primates were carried out without major change from previous years. The trend toward the utilization of chimpanzees and other large species continues, and imposes a further strain on our limited facilities.

Random source dog issues for the year are projected to 3,612. This represents the fewest dogs issued since FY 1960, when 3,443 dogs were issued. The sharp reduction during FY 1968 is of singular significance and may be attributed to the canine blood donor program which was initiated in July 1966. Eight hundred fifty units of normal whole blood were issued during FY 1968 and represented a net savings of 425 dogs. Additional savings in the numbers of dogs issued may be attributed to the improvement in quality which resulted from the 45-day conditioning period. Cats and primates were issued at approximately the same rates as in FY 1967.

The increased conditioning period for random source dogs and cats has brought about significant improvements in the physical condition of the animals at the time of issue. While the total effect of previous disease experience cannot

be corrected, the animals are in a more balanced nutritional state and their physiologic values fall more nearly within acceptable limits.

D. Problems

Continuing delay in the design and construction of the new primate facility for the Animal Center prevents development of expanded primate quarantine and breeding programs.

Animal Health

A. Objectives

To characterize and improve the health status and to study the naturally occurring diseases of laboratory animals produced, quarantined, or utilized in biomedical research at the National Institutes of Health.

B. Current Programs

Disease control in closed colonies of rodents and rabbits is achieved through a multi-disciplined approach to monitoring. Pathologists and microbiologists work closely with production personnel to identify, control, and eliminate diseases. Diagnostic service is also provided to other program areas of the Branch.

Routine control of infectious diseases of primates is approached through a program of tuberculin testing, bacteriologic monitoring, and treatment of clinically affected animals with drugs and antibiotics. Control of infectious diseases of dogs and cats is carried out through a program of routine immunization and by treatment of clinically affected animals with drugs and antibiotics. Health of ungulates is maintained through a program of preventive medicine, routine testing, and clinical veterinary medicine.

A nutritionist was added to the Branch staff during the year. A nutrition laboratory was established to deal with the nutritional problems of laboratory animals.

C. Program Progress and Accomplishments

For the first time in recent years, the production colonies suffered no major disease outbreaks.

Salmonellosis has not recurred in the guinea pig colonies since the feeding of kale was discontinued in late 1966. The data at that time indicated that kale contaminated by poultry manure had been the source of previous infections. Cabbage washed in chlorine solution with the outer leaves discarded was substituted for kale.

The results of current feeding trials indicate that commercial rations have improved, and it may be possible to omit supplemental feeding of leafy green vegetables to guinea pigs. Autoclaved hay appears to be satisfactory for the purpose of supplying bulk.

The composite sample test for coccidiosis again proved to be effective. Coccidiosis was detected in two cages in one rabbit room in January 1968 and was quickly eradicated.

Fulminant hemorrhagic pneumonia, caused by Streptococcus zooepidemicus, has continued to kill approximately 4 percent of newly purchased dogs. Although the causative agent has been found to be sensitive to high concentrations of furacin in vitro, the duration of the disease is generally too short for effective therapy to be instituted.

The incidence of intestinal parasitism in newly purchased dogs was determined during a 7-week period. The examination of fecal specimens revealed nematode infestations, primarily hookworms, in 84 percent of the dogs. The incidence was 91 percent in dogs from Virginia and North Carolina and 71 percent in dogs from Michigan and Ohio. A new anthelmintic (trade name "Task"), was tested and found to be only 58 percent effective as compared to 100 percent effectiveness reported in recent literature.

Mortality in the cat conditioning colony decreased to a new low of 7 percent. The decrease is believed to have been brought about by stopping the use of phenolic disinfectants in the rooms and stopping the feeding of canned diets high in fish content (low in thiamine).

The overall quality and appearance of conditioned random source dogs and cats have improved greatly as a result of extending the conditioning period from 30 to 45 days.

Caseous lymphadenitis in goats, first diagnosed in 1966, has occurred sporadically but, in each instance, has responded satisfactorily to antibiotic therapy.

Attempts to isolate a virus from tissues of monkeys with sloughed-out buccal pouches were unsuccessful. As in the past, this poorly understood disease affected relatively few animals.

Another peculiar and difficult-to-identify bacterium has been isolated from rats in one of the barrier rooms. The biochemical identification has been confirmed by CDC as "aberrant Citrobacter sp." with serologic relationship to the Arizona group of organisms. Both Citrobacter and Arizona organisms are considered at times to be pathogens. No disease has been attributed to the agent in the barrier room.

D. Problems

Attempts to fill vacancies for a veterinary pathologist and a veterinary clinical pathologist have been unsuccessful, due primarily to our inability to meet salary requirements for specialists in these categories.

E. Program Plans

Ongoing programs outlined above will continue.

Special and Consultative Services

A. Objectives

Special services pertaining to programs requiring the use of animals and animal facilities are provided to Institutes and Divisions on a continuing basis. These include consulting on animal problems, issuing health certificates, furnishing surgical and X-ray services, and producing and issuing blood and blood products.

B. Current Programs

Veterinarians and other professional personnel furnish NIH investigators with information and advice concerning animal anatomy, physiology, genetics, husbandry practices, and disease problems. They also give advice regarding appropriate selection of animals for experimental procedures.

Outside inquiries on animal programs and facilities are also answered. Extensive time is devoted to visitors from all parts of the United States and abroad who have specific problems and questions regarding animal facilities and care. Staff members participate in the review of plans for construction and renovation of animal facilities for our own programs and provide similar consultative services to the Institutes and Divisions.

Surgical and radiological services are provided the Institutes and Divisions, including postoperative and long-term care for animals. Limited space and service is also available for radioisotopic procedures. Assistance and facilities are provided for acute experimentation and for the collection of metabolic by-products and body fluids from animals.

C. Program Progress and Accomplishments

The Building 28 experimental surgery and X-ray facilities are operating at the same level as last year. Considerably more activity is occurring in the long-term holding of dogs; this facility is at maximum capacity. Up-dating and sophistication of equipment and techniques in the surgery and post-operative areas continue.

Requests for large animals (ungulates) have increased.

Installation of an X-ray unit in Building 100 at the Animal Center will be completed during FY 1969. This will make facilities available to NIH investigators for radiography of large (farm-type) animals for the first time. Increased numbers of experimental surgery procedures were performed in the ungulate facility at the Animal Center.

The RIF-free chicken isolator building at the Animal Center was completed. Establishment of this flock will provide additional security and increased production of RIF-free eggs.

D. Problems

Facilities are inadequate or lacking for radioisotope and infectious disease work, housing of primates postoperatively and on a long-term basis, and housing of exotic species. Additional space for ungulates is needed and funds for making additions to Building 100 have been requested.

E. Program Plans

The Branch is continuing a comprehensive consultation program to assist the Institutes and Divisions in all areas of animal care and disease control. Existing activities in these areas will be further consolidated, and the program more adequately staffed to give NIH an organized and uniform program of animal care. An expanded training program for animal caretaker personnel will be initiated in September 1968.

Media Production

A. Objectives

To produce and issue high quality bacteriological and tissue culture media and tissue culture cells under controlled conditions. To furnish consultative services to the Institutes on related matters.

B. Current Programs

Media production is programmed to meet Institute and Division requirements for standard and special media that cannot be economically or satisfactorily obtained from commercial sources. Tissue culture cell production is aimed at supplementing Institute requirements not met by commercial contracting or individual laboratory preparation. Automated equipment is utilized wherever possible.

The quality control program for media and cell production was improved this year by the addition of sterility testing of each order of tissue culture media. These additional quality control tests are proving quite satisfactory in preventing contaminated media from being delivered to the investigators.

The overall demand for tissue culture cells increased sharply this year, and the liquid nitrogen cell bank service underwent further expansion.

C. Program Progress and Accomplishments

Requisitions processed this year leveled off after a sharp upturn in FY 1967. Bacteriological and tissue culture media also leveled off after a sharp upturn in FY 1967. Requests for bacteriological plates was down slightly from FY 1967. The production of tissue culture cells was up sharply over FY 1967, and this service continues to be in great demand.

D. Problems

The Media Unit continues to suffer from the inadequacies and limitations of its existing production space. The present area has been modified to the limits possible and automation substituted wherever feasible. In view of the fact that the Unit is producing at near maximum levels, it cannot be expected that requirements imposed by the occupancy of laboratories presently under construction can be met by the existing production capacity.

E. Program Plans

A Program of Requirements for an expanded and improved media and tissue culture cell production facility is under development. Every effort will be made to point out the extreme necessity for relocating the media unit into more adequate space.

Glassware Preparation

A. Objectives

To furnish NIH investigators laboratory glassware of the highest quality by processing through the steps of decontamination, sorting, cleaning, inspecting, plugging, wrapping, sterilizing and issuing. This overall operation includes processing of used glassware from the investigators and the introduction of new glassware from replacement stock.

To furnish consultative services on problems associated with laboratory glassware.

To furnish cagewashing services to the Clinical Center, Auburn Building, and Patuxent River Laboratory. To furnish ethylene oxide gas sterilization for heat labile patient and laboratory equipment from the Clinical Center and other Institutes and Divisions, upon request.

B. Current Programs

In addition to filling Institutes' demands for the volume and types of glassware, the Unit evaluates management and technical methods and equipment for improving the quality and maintaining the volume of issued glassware.

The cagewashing unit furnishes the services cited under A and studies problems associated with corrosion, scaling, etc. Washing the rubber backed carpets for the Clinical Center is still continued, and from reports received, this is the best way found to clean them.

C. Program Progress and Accomplishments

Glassware issues to the contributing Institutes and Divisions increased slightly over FY 1967.

The 18 by 150 mm disposable culture tubes used in fraction collectors were added to the Glassware Unit's stock and, at the present time, issues are running about 20,000 monthly.

The installation of new pump screens in the M-2 glasswashing machine has cut maintenance time 80 percent.

D. Problems

As in previous years, the Unit has continued to have a problem in meeting the daily demands for glassware trays for return of dirty glassware, as well as storage baskets.

A problem in locating more than one source for the special paper to be used for the automatic pipette wrapping machine has delayed completion of this project.

E. Program Plans

A prototype cardboard carton has been found and tested for the sterilization and shipment of petri dishes. This will replace wire baskets which were previously used for this purpose. It is hoped that the cardboard box will eliminate most of the breakage and keep the dishes in a sterile condition for a longer time.

At the beginning of this fiscal year, the replenishment of new glassware was placed under the Revolving Fund. Plans are underway for the conversion of the entire Glassware Unit operation to the Revolving Fund for FY 1969.

Serial No. DRS-LAB-1

1. Laboratory Aids Branch
2. Comparative Pathology Section
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: CHRONIC MURINE PNEUMONIA OF THE ALBINO RAT

Previous Serial Number: SAME

Principal Investigator: James R. Ganaway

Other Investigators: Anton M. Allen
Thomas D. Moore

Cooperating Units: Rodent and Rabbit Production Section

Man Years

Total:	2.5
Professional:	.5
Other:	2.0

Project Description:

Objective: To elucidate the causation of Chronic Murine Pneumonia. To characterize the syndrome as it occurs in the NIH colonies. To recommend measures for the prevention and control under colony conditions.

Methods Employed: Microbiology, immunology, and pathology.

Major Findings: We have confirmed a previously published report concerning the prophylactic value of sulfonamides in preventing the development of Chronic Murine Pneumonia, thus indicating the importance of bacteria in the pathogenesis of this disease complex. Correspondingly, an association has been revealed between the severity of the lesions, as determined by histopathological studies, and the ease of isolation of a variety of bacteria from diseased rats. A manuscript covering the first phase of this work has been prepared and submitted for publication.

Significance: CMP is the greatest cause of morbidity and eventual mortality in rat colonies raised under conventional conditions. It particularly complicates, and may negate, results of any long-term study using the rat.

Proposed Course: Continuation

Honors and Awards: None

Publications: None

Serial No. DRS-LAB-2

1. Laboratory Aids Branch
2. Comparative Pathology Section
3. Bethesda

PHS-NIH

Individual Project Report

July 1, 1967 through June 30, 1968

Project Title: FOCAL NECROSIS OF THE LIVER OF RABBITS

Previous Serial Number: SAME

Principal Investigator: James R. Ganaway

Other Investigators: Thomas D. Moore
Anton M. Allen

Cooperating Units: Rodent and Rabbit Production Section

Man Years

Total: 1.5
Professional: .2
Others: 1.3

Project Description:

Objective: To characterize and identify the etiologic agent. To study the pathogenesis of the disease through experimental transmission studies. To recommend measures for control or prevention in the rabbit colonies.

Major Findings: The numbers of rabbits dying from this and other diseases has steadily declined during the past year. The reasons for this are not known. A serologic test has been developed which appears promising in preliminary studies. Further success would enable us to detect the presence of infection in the rabbit colony before spread of the disease and losses become great. Additionally, it should be possible to determine the relationship of our isolates from rabbits to that which causes Tyzzer's disease in mice.

Significance: This disease, occurring in epizootic proportions, has been the major cause of losses in the NIH rabbit production colonies in the past few years. The relationship of agents isolated from diseased rabbits at NIH to that causing Tyzzer's disease in mice remains unknown. A similar disease has also been recognized in subhuman primates by workers in England.

Proposed Course: Continuation

Honors and Awards: None

Publications: None

Serial No. DRS-LAB-3

1. Laboratory Aids Branch
2. Comparative Pathology Section
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: FEBRILE HEMORRHAGIC DISEASE OF MONKEYS

Previous Serial Number: DRS-LAB-5

Principal Investigator: Anton M. Allen

Other Investigators: Nicola Tauraso, DBS

Cooperating Units: Laboratory of Virology and Rickettsiology, DBS

Man Years

Total:	1.0
Professional:	.3
Others:	.7

Project Description: ..

Objective: To study the pathogenesis of the disease.

Methods Employed: Pathology and microbiology methods were employed.

Major Findings: The clinical features and lesions of this highly fatal disease of monkeys were described in the 1965 Annual Report. Continued histopathology studies have borne out the original findings of hemorrhage in many tissues, systemic vascular stasis, glomerulo-nephrosis and widespread necrosis of lymphatic tissues. Similar lesions are being found in monkeys given the disease experimentally (transmission studies now being accomplished in closed quarters by the Laboratory of Virology and Rickettsiology, DBS). All evidence to date indicates that the disease is caused by a small virus with characteristics similar to those of arboviruses. No evidence has been found to implicate vector transmission, however. The disease has not occurred in man and has not been successfully transmitted to animals other than the monkey. Infected tissues derived from major outbreaks of similar disease in monkeys at Sukhumi Institute, USSR, and National Center for Primate Biology, Davis, California, are presently under study. Also, a search for susceptible hosts other than the monkey is being extended in order to increase knowledge of the possible danger of epizootics in resident mammalian populations in the United States.

Significance: The disease has not been reported in the literature. The causative agent has not been identified and, therefore, the health hazard to man is unknown. The disease may be introduced into the NIH primate colony again in the future.

Proposed Course: Continuation of pathology studies in conjunction with transmission and virus isolation studies by DBS. Manuscripts on the disease outbreak, pathology findings, and isolation of the causative agent have been submitted for publication.

Honors and Awards: None

Publications: A manuscript, "Symian Hemorrhagic Fever. Part I. Clinical and Epizootiological Aspects of an Outbreak Among Quarantined Monkeys." and "Part II. Studies in Pathology," have been accepted for publication in The American Journal of Tropical Medicine and Hygiene.

Serial No. DRS-LAB-4

1. Laboratory Aids Branch
2. Animal Biologics Section
3. Poolesville

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: CANINE BLOOD DONORS

Previous Serial Number: NONE

Principal Investigator: Stephen Potkay

Other Investigators: R. D. Zinn

Cooperating Units: Experimental Surgery Section

Man Years

Total:	.55
Professional:	.05
Others:	.50

Project Description:

Objectives: To establish a colony of normal dogs to serve as blood donors. To determine the maximum frequency that a standard quantity of normal whole blood could be collected and to ascertain the required size for the donors.

Methods Employed: Five matched groups of laboratory reared dogs of the foxhound type were used. One unit of blood was obtained from each dog as follows: Group 1, once weekly; Group 2, once every second week; Group 3, once every third week; and Group 4, once every fourth week. Group 5 served as a control. The duration of the study was one year. Weekly blood samples were obtained from each dog to determine hematocrit, hemoglobin, total red and white blood cell counts, and reticulocyte count.

Major Findings: Dogs weighing 27 kg. or more were consistently able to donate normal blood at the rate of one unit every three weeks for a period of one year. Hematocrit and hemoglobin values of blood samples obtained from normal control dogs were significantly higher in winter than in summer. These differences appear to be associated with seasonal variations in temperature and sunlight.

Significance: The results indicate that a colony of donor dogs bled on a repetitive schedule can provide normal whole blood for research purposes. The use of such colonies to supplant the current practice of exsanguinating dogs for blood is proposed.

Proposed Course: Completed

Honors and Awards: None

Publications: A manuscript has been submitted for publication.

Serial No. DRS-LAB-5

1. Laboratory Aids Branch
2. Animal Biologics Section
3. Poolesville

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: THE EFFECTS OF A HEMATINIC ON THE BLOOD
PICTURE OF DONOR DOGS

Previous Serial Number: NONE

Principal Investigator: Chester W. Anderson

Other Investigators: Stephen Potkay

Cooperating Units: None

Man Years

Total:	.40
Professional:	.20
Others:	.20

Project Description: ..

Objective: To determine the effects of an iron-rich hematinic on the erythroid cell series of canine blood donors, with a view toward increasing the blood production from the donor colony.

Methods Employed: Canine blood donors are bled at 2, 3, and 4 week intervals. They receive injections of iron-dextran which are designed to replace the iron loss accompanying volume blood donation. Injections are administered two days following the donation. Hematocrit, hemoglobin, red and white cell counts, and plasma protein determinations are made each week. The results are charted and compared to those obtained from control dogs which are bled on an identical schedule but do not receive iron injections.

Major Findings: Preliminary evaluation of the data indicates that parenteral supplementation with iron enhances red blood cell production in donor dogs, and decreases the time required for cellular elements to return to normal.

Significance: The current bleeding schedule for donor dogs is once every three weeks. Parenteral administration of iron to donor dogs may permit more frequent bleeding and result in better utilization of the donor colony.

Proposed Course: Continuation

Honors and Awards: None

Publications: None

Serial No. DRS-LAB-6
1. Laboratory Aids Branch
2. Animal Biologics Section
3. Poolesville

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: CANINE HEMOLYTIC ANEMIA

Previous Serial Number: NONE

Principal Investigator: Chester W. Anderson

Other Investigators: Mary C. Strott
Stephen Potkay

Cooperating Unit: None

Man Years:

Total:	.5
Professional:	.3
Others:	.2

Project Description:

Objectives: To add further to the knowledge of the following: 1) hemolytic anemia in the puppy caused by mating dogs and bitches with incompatible blood groups; 2) the mechanism of antibody transfer from the bitch to the pup; 3) the genetics involved in the transfer of the A factor in the canine.

Methods Employed: Matings between dogs of similar and incompatible blood groups are made. Bitches are titered throughout gestation to note any rise in titer of the anti-A factor. Puppies are blood grouped and titered for the anti-A factor before and after nursing for the first time, and daily for the first several days of life. Milk samples are titered for the anti-A antibody. Several matings of both a compatible and incompatible nature will be made with each bitch.

Major Findings: No results have been obtained yet.

Significance: This project will contribute to understanding mechanisms of disease which produce hemolytic anemia in puppies. This disease has not been clearly characterized in the literature but is generally included with other neonatal diseases under the heading of the fading puppy syndrome.

Proposed Course: Continuation

Honors and Awards: None

Publications: None

Serial No. DRS-LAB-7
1. Laboratory Aids Branch
2. Animal Biologics Section
3. Poolsville

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: HEMATOLOGIC AND BACTERIOLOGIC CHARACTERISTICS
OF STORED CANINE BLOOD

Previous Serial Number: NONE

Principal Investigator: Stephen Potkay

Other Investigators: Chester W. Anderson

Cooperating Units: None

Man Years

Total:	.3
Professional:	.08
Others:	.22

Project Description:

Objectives: 1. To determine the bacteriologic status of blood derived from dogs that are normal and healthy as judged by applicable standard clinical and laboratory criteria, and to evaluate methods of obtaining sterile blood. 2. To determine the influence of anticoagulants, storage time, storage temperatures, and storage containers on whole canine blood. 3. To establish standards and methods for the routine sterility testing of blood produced by the Carnivore Unit.

Methods Employed: Blood (500 ml) was collected into blood bags using a hemolator or into vacuum bottles containing heparin, ACD, or CPD as anti-coagulants. Blood was stored for 24 and 48 hours in heparin and for 3, 5, 10, and 21 days in ACD and CPD at 3° C. Determinations of the cellular components of the blood and its sterility were made at the end of these periods and compared to values obtained from the donor dogs immediately prior to volume collection.

Major Findings: Preliminary examination of the data indicates that bacterial contamination occurred in less than 5 percent of the samples. Cellular changes in refrigerated canine blood appear to be minor at 24 hours in the case of heparinized blood and at five days in the case of blood stored in ACD and CPD.

Significance: The feasibility of supplying sterile blood from a canine donor colony for use in research was demonstrated. Storage of heparinized blood for 24 hours and ACD or CPD blood for up to five days did not appear to reduce its usefulness for research purposes. Such blood can be issued in place of fresh blood, thus increasing the efficiency of the blood program.

Proposed Course: Completion

Honors and Awards: None

Publications: None

Serial No. DRS-LAB-8

1. Laboratory Aids Branch
2. Animal Biologics Section
3. Poolesville

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: FEED CONSUMPTION STUDIES IN THE CANINE

Previous Serial Number: NONE

Principal Investigator: Chester W. Anderson

Other Investigators: Stephen Potkay

Cooperating Units: None

Man Years

Total:	.8
Professional:	.2
Others:	.6

Project Description: ..

Objectives: 1. To determine the feed consumption per kilogram body weight in puppies from birth to one year of age. 2. To determine the feed consumption per kilogram body weight in bitches from breeding through parturition and lactation to weaning. 3. To determine the feed consumption per kilogram body weight in donor dogs on an active donation schedule. 4. To determine the feed consumption per kilogram body weight in "resting" dogs, such as open bitches, males, and cell donors.

Methods Employed: Dogs are weighed at weekly intervals and a record kept on the amount of feed consumed. The results are graphed, and values are determined.

Major Findings: Data have not been tabulated.

Significance: Standard growth curves will be obtained for American and English foxhounds where none presently exist. The data will also contribute to the determination of costs for housing and rearing dogs in the colony.

Proposed Course: Continuation

Honors and Awards: None

Publications: None

DIVISION OF RESEARCH SERVICES

Summary of Branch Activities

July 1, 1967, through June 30, 1968

ENVIRONMENTAL SERVICES BRANCH

Edwin M. Lamphere, Chief

I. SUMMARY

In order to increase the effectiveness of the Branch, an extensive reorganization was completed. The previous organization established on the basis of professional categories was abandoned in favor of the new organization, based on functional programs.

Much of the Branch workload continued to consist of solving individual problems on a short-term basis but this type of work has been declining for several years. More time is being spent on activities which lead to solving problems on a larger scale.

The development of complex environmental equipment has provided a better environment. Laminar flow hoods provide excellent protection for the research experiment but about 90 percent have been found to be less than fully satisfactory as delivered. A program of checking all newly purchased units was initiated.

Properly functioning chemical fume hoods can probably prevent more industrial hygiene problems in the laboratories than any other single factor. A survey of the approximately 800 hoods at NIH was completed. Each hood was marked with the condition under which it would operate satisfactorily.

An environmental survey of Buildings 29 and 29A was completed. In general, these surveys include determination of the work in progress, and a check of equipment, services, etc., used for control of any potentially hazardous material. A study carried out by the Branch has shown that the usual 30-minute autoclave cycle at 15 psi does not result in reliable sterilization of used glassware. Sixty minutes was found to be adequate.

Ultraviolet lamps are widely used at NIH to control microbiological contamination. Decontaminating capabilities disappear long before there is any visible evidence of bulb failure, however. A continuing program for checking all UV installation was initiated. The number of defective lamps ranged from a low of 15 percent to a high of 50 percent in various buildings.

An essential part of the biological hazards control activities is the development of facilities which will allow hazardous work to be carried out in an ordinary laboratory building. Such a facility was developed for

NINDB on the fifth floor of Building 36. All facilities necessary for working with hazardous organisms will be included.

Pseudomonas causes more hospital-acquired infections than any organism except Staph. aureus. A typing method was perfected and put into use which shows that the same types are found in the patient as in the environment. This has not been shown conclusively elsewhere.

Training is always important and is especially important in areas where competent personnel are in short supply. Hospital sanitarians are in very short supply, and a training program was developed and put into effect in conjunction with Bureau of Health Services.

II. BRANCH PROGRAMS

A. Objective

The objective of the Environmental Services Branch is to insure that a satisfactory environment is maintained at NIH and its field stations.

B. Current Programs

Attainment of the Branch objective was approached through four closely coordinated functional program areas:

1. Hospital Sanitation
2. Control of Biological Hazards
3. Industrial Hygiene
4. Water Supply

Administratively, the Branch continued to approach its objective by serving as a consultant to line management in the Institutes and Divisions. However, more emphasis was placed on working with individual scientists than in the past, since it is important to establish a base of mutual understanding, especially in the area of biological hazards control. Recognizing that scientists and I/D management have a wide variety of problems other than those associated with the environment, it is the policy of the Branch to present solutions in addition to a statement of the problems which are found. Every attempt is made to tailor these solutions to the administrative as well as the technical aspects of the problem.

Much of the Branch workload continued to be of a trouble-shooting nature, whereby an individual problem is solved in response to a specific request. This type of work has declined every year for the past several years, and more time has been spent on scheduled surveillance activities, special surveys, and solving problems on a much larger scale.

With regard to individual programs, hospital sanitation activities in the past have been concerned only with the patient care areas of Building 10,

and have dealt with the environmental aspects of Clinical Center's overall infection control effort. During the past year, however, assistance was provided to NCI's clinical care program at the USPHS Hospital in Baltimore.

In the Clinical Center, all operating rooms are surveyed on a quarterly basis. Regular monthly surveys are carried out on the six Nursing Units where potential for cross-infection is greatest and on other randomly selected Nursing Units. Regular surveys are also carried out in any area where a potential problem of a temporary nature exists. The Formula Room, Central Sterile Supply, Physical Therapy, Blood Bank, Laundry, and similar areas are checked routinely. Samples of milk and formula room products are tested for bacterial contamination on a weekly or monthly schedule depending upon the item. As part of the hospital program, bacteriology laboratory services and professional consultations are furnished for any Clinical Center program which may involve environmental bacteriology. All laboratory work associated with insuring the necessary quality of air, food, and liquids on the Life Island project is carried out by the Branch.

A considerable amount of laboratory time is also furnished to the Department of Environmental Sanitation Control on studies of relative merits of various cleaning procedures, etc. In addition to the more routine work, the hospital program also carries out special studies for the purpose of solving problems before they occur and for upgrading the quality of the environment generally.

The program for control of biological hazards covers all NIH facilities, both at Bethesda and in the field, with the exception of the patient care areas of the Clinical Center. Activities of the biological hazards control program deal with identification and surveillance of potentially hazardous laboratory and animal room areas; regular surveillance of all animal facilities as part of an overall DRS effort; semiannual inspection of cafeterias, snack bars, and vending machine operations; general surveillance of housekeeping and waste disposal practices; developing, adapting, and evaluating equipment for containing hazardous organisms with minimum interference for the scientist; and development of containment systems and procedures which will allow hazardous work to be carried out in ordinary laboratory buildings.

The industrial hygiene program is similar in many ways to the biological control program except that it deals with potentially harmful non-living, rather than living, contaminants. Of greatest importance are toxic fumes generated in chemistry laboratories; some of the industrial processes carried out in DRS; and potentially harmful particulates, such as some of the carcinogenic chemicals. Other aspects of the industrial hygiene program deal with environmental factors which, while not harmful, affect the comfort, and therefore the efficiency, of NIH employees. Examples of items which are included in this category are noxious fumes, temperature extremes, odors, air pollution, and illumination.

Water supply activities are concerned primarily with the quality of potable and distilled water. Almost all present work is associated with monitoring water supplies and determining the cause of any deterioration in quality. All central distilled water supplies are checked weekly for specific resistance, with the exception of Building 10 where the supply is checked daily. An analysis of the copper content of all distilled water supplies at Bethesda and in the field is carried out quarterly. Potable water supplied to NIH is checked monthly for possible bacterial contamination and for adequate chlorine residual.

C. Program Progress and Accomplishments

While the amount of short-term work items of the trouble-shooting nature increased, at the same time the effort committed to problem solving and problem prevention on a larger scale also increased.

One of the most effective methods for preventing problems in laboratory buildings is to prevent these problems from being built-in during design and construction. The Branch has always devoted considerable time to review of plans for new facilities. In addition, to minimize future problems in the highly complex Building 41, an engineer was assigned on a half-time basis to watch for developing environmental problems and to serve in a liaison capacity between the NCI scientific staff and DRS construction engineers. The facilities to be constructed in North Carolina for the Division of Environmental Health Sciences are also very complex from the standpoint of controlling the research environment, and about 15 percent of an engineer's time has been devoted to this facility. The number of problems resolved during the construction of Building 41 has already shown that the effort expended in that direction is worthwhile. It is expected that the effort expended on the North Carolina activities will be equally worthwhile.

Development of more complicated methods and equipment for controlling the environment leads to a definite improvement in the environment, but not necessarily to a reduction in workload for environmental control personnel. As these methods and equipment become more complex, a greater amount of effort must be expended in insuring satisfactory operation. The problems associated with insuring satisfactory operation of laminar flow hoods are an example of this situation. These units, when operating correctly, provide protection to the research experiment which is not attainable by any other means. When not operating correctly, their usefulness is very limited. Satisfactory or non-satisfactory operation is almost entirely a function of filter installation. A program was initiated for acceptance tests of filters on all new units by the dioctyl phthalate method. Ninety percent of the newly purchased hoods were found to have defective filtering systems. A program was also initiated for checking the units after the filters have been changed.

Air filters, in addition to solving many problems associated with protecting the research experiment, also have widespread use in protecting personnel from potentially hazardous microorganisms. A program was initiated for checking exhaust filters on buildings such as 29A and Building 6, and the more critical biological safety cabinets. This program consists of a visual

inspection every six months for physical damage, a rough efficiency check annually, and a careful check every two years, or when the filter is changed.

Properly functioning chemical and radiological fume hoods can probably prevent more industrial hygiene problems associated with the laboratory environment than any other single factor. In situations where the hood may not be adequate for hazardous work, it is important that the scientist be aware of the limitation. An initial survey of the approximately 800 fume hoods in Bethesda and at the Gerontology Building was completed. All hoods were marked with a label stating either the condition under which it will operate satisfactorily or that the hood is not satisfactory for use with hazardous materials. About 50 percent of the hoods in Building 10 and about 75 percent of the hoods in the other buildings met minimum standards for satisfactory operation.

With the performance of these hoods known, the next logical step in solving or preventing problems is to evaluate other aspects of the control of the more important potentially hazardous chemicals. Along these lines, work was initiated on the control of problems associated with the use of carcinogenic chemicals.

The use of ultraviolet lights is an important method for controlling microbiological contamination in research laboratories. Effectiveness, however, is dependent on proper maintenance. The fact that the bulb may emit visible light does not necessarily indicate any decontaminating capabilities. The bulk of the approximately 400 UV lamps in use at NIH are located in Buildings 7, 10, 29, and 29A. A surveillance program was initiated and all 280 lamps in Buildings 7, 29, and 29A, and about half of those in Building 10 were checked. The number of ineffective lamps was found to range from a low of 15 percent to a high of 50 percent in the various buildings. The UV installations will be checked at six-month intervals until a definite improvement is noted.

A necessary part of the biological hazards control program as conducted at NIH is the development of laboratory facilities which will allow hazardous work to be carried out in an ordinary laboratory building. Such a facility was developed for NINDB on the fifth floor of Building 36. This facility, which comprises the "C" corridor area, will be equipped with air locks, showers, pass-through autoclaves, special ventilation system, liquid waste treatment, and other appurtenances necessary to protect the scientists and the community.

Building surveys are another important aspect of the biohazards program and detailed surveys of Building 29 and 29A were completed. In brief, surveys of this type included determining the type of work in progress, and checking items such as (a) direction of air flow in critical areas, (b) autoclaves, (c) UV lights, (d) waste handling practices, (e) containment equipment, and (f) housekeeping practices.

Work is now underway at the Middle America Research Unit on implementing the ESB recommendations for critical immediate needs for controlling biological

hazards. This work is fairly extensive and includes filtration of air from the hot suite, installation of a large pass-through autoclave and a cage washer, and modification of housekeeping practices.

While considerable attention is given to checking autoclaves for satisfactory mechanical operation, procedures which are tailored to fit the material to be decontaminated are also very important. A study carried out by the Branch has shown that the usual 30-minute sterilizing cycle at 15 psi is not adequate when using the standard NIH autoclave pan. A 45-minute cycle will result in survival of indicating organisms in up to 10 percent of the cases. A 60-minute cycle has been shown to be adequate, however, and the Institutes have been advised of these findings.

General cleanliness is an important step in control of undesirable micro-organisms, both in the laboratory and in the hospital. At present, a real problem results from casework which is difficult to clean. ESB has a representative on the National Sanitation Foundation's "Committee on Hospital Cabinetry and Laboratory Furniture." This committee was organized to develop standards for construction which, among other things, will insure easy cleanability. It is expected that the standards will be completed by the fall of 1969.

During the past year a DRS program for supporting the Institutes in the animal care field was established. The DRS team consists of staff members from LAB and ESB. In connection with this program, inspections for conformance with accreditation standards of the American Association of Laboratory Animal Care were carried out in NCI, NIDR, and NIAID. ESB was responsible for evaluation of sanitation and physical facilities. In general, these aspects were reasonably satisfactory.

Pseudomonas is a very common organism in hospitals and will grow almost anywhere that there is a little moisture. In the Clinical Center, Pseudomonas infections are more common than those caused by any organism except Staph. aureus. A typing method was adapted in essential features in FY 1967 and was perfected and put into use in 1968. It has been possible to show that the same types are found in the infected patient and in the environment. This has not been shown conclusively elsewhere and it gives the justification necessary for a greater emphasis on decontaminating the sources of the organism.

Training is always important in the environmental health field and particularly important in areas where competent personnel are in short supply. Qualified hospital sanitarians are needed by the Service and other health-oriented organizations, but are very rare. A cooperative Bureau of Health Services-NIH training program for hospital sanitarians was developed and put into effect in January 1968.

In order to increase the effectiveness of the Branch, an extensive reorganization was carried out. Previously, there have been two sections--one oriented toward the physical sciences and the other oriented toward the biological sciences. This type of organization results in good technical supervision but does not easily lend itself to programs which require both

types of personnel on a day-to-day basis. Therefore, an organization based on functional programs rather than professional disciplines was adapted. The reorganization also provided the means to take better advantage of opportunities for program progress in the areas of research and development; training; and organized liaison with design, construction, and maintenance groups.

The detergent formulation used at NIH through FY 1968 was developed in 1954. Characteristics of the water supplied to NIH have changed drastically since that time, and the old formula is no longer compatible with present water quality. In addition, there has been considerable progress in detergent chemistry in the past 14 years. A consultant was retained to investigate NIH's washing needs and to develop formulas for cage washing and for glassware washing.

D. Problems

There were a variety of internal problems resulting from the fact that the organizational structure did not mesh with program needs and the fact that there were not sufficient senior staff members to provide continuous guidance to the large number of new junior personnel. All non-supervisory engineers, and most of the non-supervisory professionals in other categories transferred and were replaced during the last six months of calendar 1966. There is no way to avoid the biannual turnover for engineers as long as primary reliance is placed on young officers on two-year career development assignments. This problem will be alleviated by staffing partially with the higher-grade engineers which the present program requires. It is expected that problems attributable to an inconvenient organizational structure will be solved by the reorganization.

While there was marked progress in the area of biohazards control, it was sufficiently slow to leave many unresolved problems, and to cause much staff frustration.

In the situations where the scientist resists using containment equipment or other protective devices, very often one of two things occurs: (1) there is agreement that action should be taken but nothing is done, or (2) questions are raised as to whether ESB has correctly assessed the risk. The solution to the question of risk assessment will also tend to alleviate the remainder of problems. It is planned to request the Institutes to appoint a committee of at least three scientists who will assess the risks in their Institute. Under this situation ESB would continue to locate problems and to carry out detailed investigations. The committee would decide the degree of hazard involved, and ESB would recommend protective measures commensurate with the hazard. The virologist available on the ESB staff will also be of considerable assistance in problems of this type.

Lack of knowledge of even near-term Institute plans was more of the problem than usual this year. For example, many potentially hazardous laboratory operations will move to Building 37 when it is completed and, while some steps are underway, the necessary facilities are not being provided. As of May 1, space allocations were not sufficiently definite to allow for

provision of the necessary protective measures. In many cases little can be done about lack of knowledge of Institute plans. However, when the problem involves facilities, it may be possible to delay design and construction until adequate plans are submitted. This approach will be pursued with the Director's Office, DRS.

A variety of problems arose during the year with other organizational groups involved in environmental health activities. Problems of this type will probably always exist but will be lessened if mutual agreement on respective roles can be reached. A series of discussions has been initiated for the purpose of reaching such an agreement.

E. Program Plans

No change in objectives of the Branch is foreseen, but some changes in staffing patterns and in methods of approach are planned. The heavy reliance on staffing with junior engineers and sanitarians will be lessened, since the Branch cannot function at an optimum degree of effectiveness if the non-supervisory staff leaves and must be replaced every two years. This change in staffing pattern is also in keeping with plans for a somewhat modified approach in dealing with the Institutes. While the Branch will continue to function in a consultant capacity to Institute management, more emphasis will be placed on working with and convincing the individual scientist. This requires personnel in whom the researcher can have confidence, and who can operate independently of detailed ESB supervision. With the relatively large number of non-clear-cut situations which occur, particularly in the biohazards control area, the practice of locating potential problems in the laboratories and submitting recommendation to the Scientific Director has not resulted in the desired progress.

It is planned that much more emphasis will be placed on training than in the past, with informal as well as formal training receiving attention. The informal training will be an integral part of the plan to work more closely with researchers. With regard to formal training, a training officer has been recruited to initiate, coordinate, and follow through on Branch activities in this area. It is planned to start training courses for animal caretakers in conjunction with LAB, and for laboratory technicians in connection with biological safety programs. In addition, it is planned to expand the training effort in the Clinical Center.

Development activities will receive more attention than in the past, and a definite Branch program in this area will be carried out. It is expected that development of laboratory and field methods for evaluating the environment, evaluation of laminar flow and similar equipment, and evaluation and control of the shedding of microorganisms from the skin will receive major emphasis.

Two new activities, within already developed program areas, will be started during the coming year. A virologist was recruited, and an active virology laboratory program will be carried out in support of the biological control activities. Initial emphasis will be placed on developing methods for collecting viruses from the environment. Another activity to receive

priority this coming year is evaluation of problems associated with the use of carcinogenic chemicals in laboratories and the development of whatever control measures are indicated.

F. Publications

Cook, R. O.: A New Ventilated Isolation Cage, Applied Microbiology, May 1968.

Leary, A. G. and Radden, E. B.: Evaluate Performance of HEPA Filters in Clean Benches, Heating, Piping-Air Conditioning, 39:117-119, Sept. 1967.

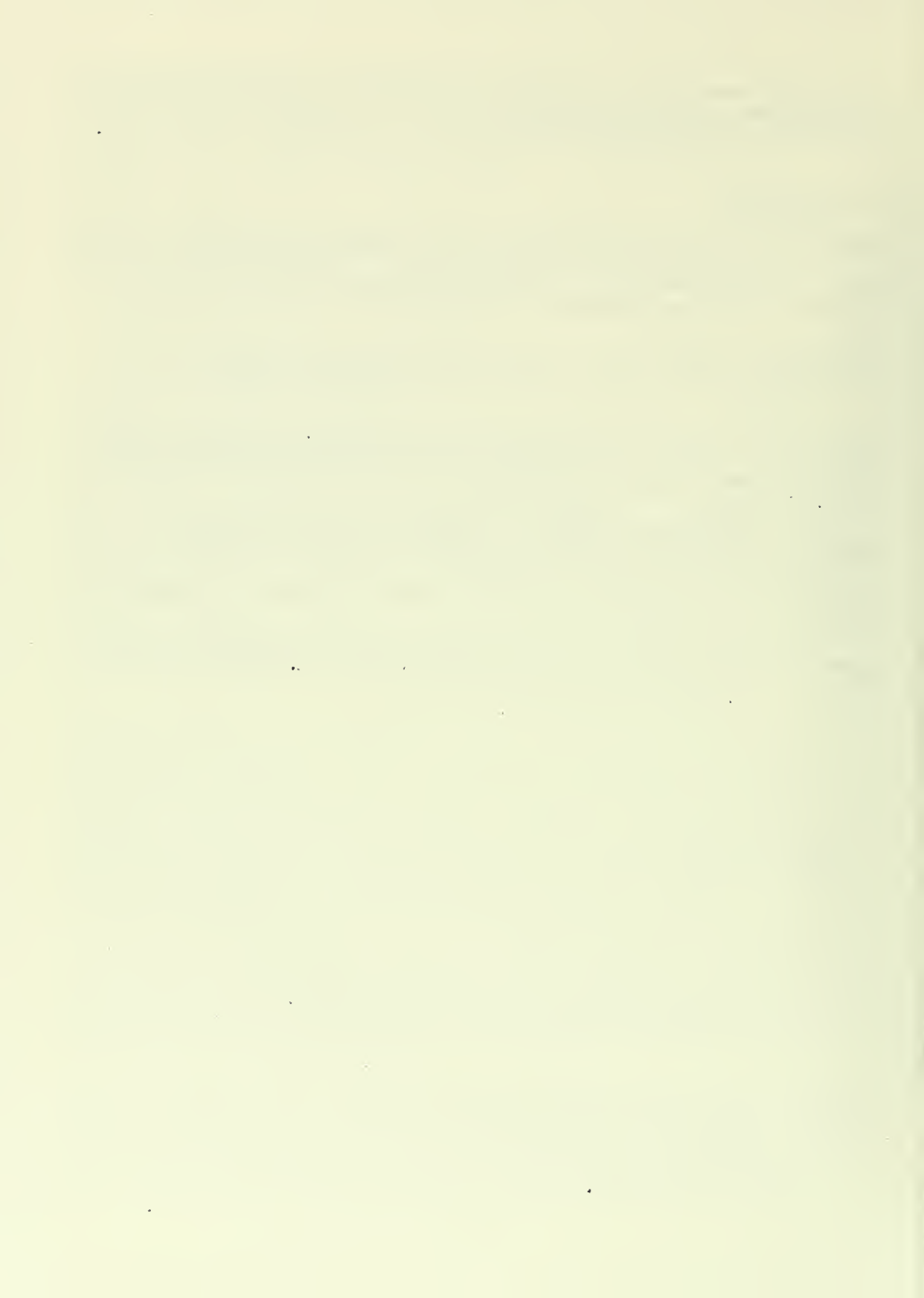
Levitan, Seidler, Herman, L. G., and Strong: Bacteriological Surveillance of the Patient Isolator System, Archives of Environmental Health, Vol. 14, pp. 837, 1967.

Herman, L. G.: Control of Biological Agents as Contaminants in Microbiological Laboratories, Disinfection, Sterilization and Preservation, published by Lea & Febiger, Philadelphia, 1968, Pt V, Ch. 34, pp. 543, Editors: Lawrence, C. A. and Block, S. S.

Fox, D. G.: Contamination Levels in a Laminar Flow Operating Room, HOSPITALS, Journal of the American Hospital Association, June 1968.

Herman, L. G.: Decontamination and Sterilization, Executive Housekeeper, May 1968.

Herman, L. G. and Powell, W. V., Biological Agents as Contaminants in the Industrial Laboratory, Developments in Industrial Microbiology, Vol. 8.



DIVISION OF RESEARCH SERVICES

Summary of Branch Activities

July 1, 1967, through June 30, 1968

BIOMEDICAL ENGINEERING AND INSTRUMENTATION BRANCH Dr. Lester Goodman, Chief

I. SUMMARY

Fiscal year 1968 was a period of vigorous activity and substantive progress toward fulfilling Branch objectives. For the past several years, BEIB has been building a highly competent group of professional and technical personnel. The Branch has now gained a reputation as a national focal point for engineering competence and authority in biomedicine. Major emphasis is placed on stimulating direct collaboration between BEIB professional staff and intramural researchers in the conduct of biomedical research and development programs. In addition, individual improvement is promoted through an education and training program to further enhance the Branch's capabilities and effectiveness.

The Technical Services sections, Instrument Fabrication and Systems Maintenance, achieved unprecedented peaks in productivity during FY 1968. These sections performed 11,550 assignments during the year at a value of \$1,026,000, an increase of 5 percent in jobs and 11.3 percent in dollars over the previous annual high, reached in FY 1967.

Branch professional staff have been involved in approximately 400 research and development tasks. Although the total number of projects has not changed significantly from the previous year, there has been a distinct increase in the level of sophistication of technical collaboration and support provided to the NIH community, with a concomitant increase in the percentage of long-term programs. The year has seen noteworthy original contributions in the areas of artificial organs, materials, laser technology, mechanization, automation, physiological monitoring, patient care, and physiological systems analysis.

The concept of satellite operation has been realized in substance. The Clinical Center Technical Support Unit has been reorganized, and one new satellite located in NCI, Building 37, is expected to be functioning early in FY 1969.

A modest program has been initiated for more economic use of scientific equipment. Experience to date shows growing acceptance of the concept by the NIH community.

Full realization of potential has been curtailed by budgetary restrictions. However, a firm base has been established for prompt, positive action when the occasion demands.

II. BRANCH PROGRAMS

A. Objectives

To fulfill the need for engineering knowledge and technical skills in pursuit of health research at NIH.

To provide direct and consultative engineering support to clinical and biomedical research projects, including advice on systems analysis, experimental design, and synthesis of technical expedients.

To design, develop, fabricate, and evaluate special-purpose devices and systems not commercially available.

To maintain and repair scientific laboratory and clinical equipment.

To provide communication between NIH and the general public on engineering support to clinical and biomedical research.

To serve as a source of informed authority in matters pertaining to engineering in medicine and biology.

B. Current Programs

The primary purpose of the Branch is to provide service and support to the intramural program of the NIH. BEIB activities, therefore, are identified with many of the individual programs that constitute the intramural research effort. The overall Branch program is best described as the coordinated effort of its operating units.

1. Instrument Fabrication Section

a. Prepares minor designs of, makes modifications to, and fabricates biomedical equipment and instrumentation systems.

b. Produces devices requiring special tools and skills in the electronic, electrical, glass, mechanical, optical, rubber, plastics, welding, and sheet metal categories.

2. Systems Maintenance Section

a. Maintains and repairs biomedical equipment and instrumentation systems.

b. Instructs technicians and scientists in the proper use and operation of especially complex instruments and devices.

3. Electrical and Electronic Engineering Section

a. Collaborates with intramural professional staff in fundamental and applied projects relevant to biomedical research and health care.

b. Provides consultative electrical and electronic engineering support to biomedical research projects at NIH.

c. Designs, develops, and evaluates electrical and electronic instrumentation and equipment used in research and clinical applications.

d. Provides communication between NIH and the general public on electrical and electronic engineering support to biomedical research and clinical practice.

4. Chemical Engineering Section

a. Provides consultative chemical engineering support to biomedical research projects at NIH.

b. Designs, develops, and evaluates chemical instrumentation and equipment used in research and clinical applications.

c. Provides communication between NIH and the general public on chemical engineering support to biomedical research and clinical practice.

5. Mechanical Engineering Section

a. Provides consultative mechanical engineering support to biomedical research projects at NIH.

b. Designs, develops, and evaluates mechanical instrumentation and equipment used in research and clinical applications.

c. Provides communication between NIH and the general public on mechanical engineering support to biomedical research and clinical practice.

6. Branch Engineers

These senior professionals serve as staff consultants in the Office of the Chief and are assigned to organize, conduct, and oversee particular comprehensive, long-range research and development projects. They provide unique scientific and engineering knowledge to the Branch and NIH.

7. Supply Unit

Provides for the acquisition and disposition of materials, parts, and equipment required for Branch operations. Maintains controlled inventory stocks and records.

8. Satellites

Satellites are technical support units, composed of selected engineers and technicians with appropriate shop facilities, located in certain areas where it is beneficial to make typical BEIB support and service immediately available via a controlled degree of decentralization. They are responsive to demands of local programs and operate as integral parts of the resident team but are administratively responsible to the central Branch. Each is especially tailored to meet specific needs of the host Institute or Division. Satellite operation supplies the host with the advantages of a proprietary technical group and maintains the chief benefits of centralized resources.

C. Program Progress and Accomplishments

The effectiveness of service and support by BEIB to the research program of NIH continues to improve. This results directly from (1) emphasis on the role of professional physical scientists and engineers as collaborators in health research, and (2) improved stability of the technical services work force at a higher level of experience and competence. The entire staff of BEIB shares this improved status with the direct results of greater personal pride in the Branch, improved morale, increased productivity, and higher efficiency.

1. Workload

Modifications in workload data gathering and reporting, initiated in the previous year, have been a significant aid in Branch management. Improved methods are evolving as experience increases and program activities progress.

The IFS processed approximately 4,180 different project assignments involving minor design, fabrication, or major modification. The SMS processed approximately 7,370 different project assignments involving maintenance, repair, or minor modification.

BEIB engineers were involved with approximately 400 different research and development tasks. The number of comprehensive long-range projects with which the Branch is involved has significantly increased as BEIB's role in the NIH program evolves. Individual projects of special research interest are detailed in Section III. Program areas that continue to receive considerable attention are as follows:

a. Improved techniques and systems for physiological monitoring in surgery and intensive patient care.

b. Systems design and construction for mechanizing and automating laboratory and clinical procedures.

c. Research and development in artificial organs and prostheses, including studies of basic phenomena and construction of devices for artificial heart components and hemodialysis therapy.

d. Systems design and construction of devices to gain more benefits from automatic data processing and electronic computation and control.

e. Improving tools for cardiac and neurosurgery.

f. Developing the laser as a useful device in life science research and therapy, as well as extending its physical potential.

g. Research and development on the synthesis of special materials for biomedical applications.

h. Analysis and modeling of physiological phenomena especially related to therapeutic processes.

2. Technical Advances

BEIB has delivered a considerable number of special-purpose devices and systems in support of Institute research projects. Items of more than casual interest follow:

A fixed bed adsorber device produces platelet-deficient animal blood more effectively than other known chemical or radiological techniques.

An electronic control for a pneumatic heart assist device appropriately operates a solenoid valve, based on ECG and blood pressure and provides several operating modes, parameter adjustments, and hazard prevention interlocks.

A very small mass photoelectric displacement transducer measures heart muscle motion with resolution to fractions of a micron.

A temperature monitoring system for hypothermia operations in neurosurgery furnishes 0.1°C accuracy and two data recording channels.

A programmable digital sample dispenser expedites operation of an automated clinical chemistry system.

A muscle motion transducing system, featuring very light mechanical loading of the muscle, provides voltage readouts for acceleration, velocity, and displacement.

An impedance, voltage, and current monitoring unit presents a visual display of electrical impedance, voltage, and current between any two selected probes in the patient's brain.

A feedback control system automates operation of a Langmuir trough surface tension apparatus.

A multiple auto-valving device for chromatographic cabinets permits initiation of solvent flow automatically at any preset time.

A device to produce intra-ventricular fibrillation for an extended period of time during surgery enables quick return to autonomous function following heart-lung bypass disconnect.

A photoelectric blood clot sensor aids in studying thrombogenic properties of prosthetic materials.

A servo control system maintains a preset stress level in heart muscle during a portion of each cardiac cycle.

An improved pipette plugging machine accepts mixed sizes of pipettes and plugs them at a rate of 25 per minute.

A solid state electronic differential calorimeter features automatic computation of the difference in specific heats.

A rat activity monitor senses activity photoelectrically and totalizes events separately for six compartments.

A media changer automatically deracks, uncaps, replaces spent media with fresh media, then recaps, and reracks test tubes at the rate of one every 12 seconds.

An electronic log-log converter converts exponentially decaying current from a photomultiplier to a linear ramp voltage and differentiates to obtain an output proportional to the rate constant.

A mass ratio meter improves accuracy and precision of mass spectrometer analyses.

A solid state log converter for use with an existing spectrophotometer, features digital readout and operation with currents down to 100 pico-amperes.

An electronic monitor for the 10A Cardiac Surgery recording system provides an instant check of system readiness and indicates source of malfunction.

A ground loss alarm safety system for operating suites responds when patient electrical ground is interrupted.

A pyrex multichannel electrophoresis apparatus enables analyses of macromolecular mixtures using polyacrylamide gels which are effective over a maximum range of pH and pore sizes.

Vacuum formed plastic disposable toilet inserts to collect specimens significantly reduce costs for large-scale patient studies.

A molded plastic stereotaxic platform for use on monkeys replaces more expensive conventional all-metal devices.

A triple X-ray defraction detector provides for three simultaneous recording channels.

A new perfusion chamber improves studies of kidney tubule function.

An automatic dispensing and recycling viscometer expedites analyses of chemical reaction rates with superior resolution and speed.

A novel recycling device for a counter current distribution machine, used for the separation of antibiotics, reduces changeover time between modes of operation from 30 minutes to 3 seconds.

3. Inventory and Supply

Technical procurement operations, heretofore split between management and fee-for-service activities, have been centralized within the supply unit. The arrangement has improved service and provided Branch management with better cost analysis of operating expenses.

Inventory replenishment contracts with the Beckman Corporation, Spingo and Spid Divisions, were negotiated during the year and resulted in more efficient and timely acquisition and stocking of replacement parts.

The use of blanket purchase orders was expanded considerably during the past year. Simplified procurement procedures, resulting from increased delegation of procurement authority from the SMB Procurement Section, have materially reduced the volume of formal purchase orders and produced concomitant savings.

4. Service Contracts

The Branch encourages the use of contractual services, with special emphasis on service-type contract with certain scientific equipment suppliers. Fixed price contracts with Beckman Corporation, Spingo and Spid Divisions, have proven beneficial to the scientific staff. The class of equipment covered includes centrifuges, spectrophotometers, pH meters, gas chromatographs, and liquid scintillator counters. Specific benefits provide:

a. Consulting services on custom engineering modifications and special accessories.

b. Information for researchers and technicians on new techniques and applications as developed.

c. Guidance and assistance in setting up scheduled service and maintenance programs.

A contract with the Materials Evaluation Laboratory, National Bureau of Standards, provides NBS equipment and personnel for testing elastomer formulations and specimens provided by BEIB and reports on data such as rheograph curves and stress-strain relationships. It further provides data in support of the biomaterials development program which is not available at NIH because of lack of suitable equipment.

5. Training

An effective professional and technical training program provides improved, up-to-date support to NIH in engineering, fabrication, and maintenance. Forty-nine employees participated in academic and technical courses. Thirty-eight (382½ man days) attended formal education and training courses. Eleven (73 man days) received specialized training on scientific equipment at suppliers' plants and at the NIH.

One BEIB engineer has been on full-time assignment to pursue the MS degree at the University of West Virginia.

The following were conducted jointly by BEIB/SMS and Beckman Instrument Company under the terms of Contract #43-68-66:

a. A one-day "Spingo Amino Acid Analyzer" course presented by Dr. Erhard Gross, NIAMD, to 30 scientific and technical attendees.

b. A two-day seminar on "Zonal Centrifugation." The seminar, repeated six times, was attended by a total of 120 employees, primarily from the NIH and other Government agencies in the Washington Metropolitan area. The instructor was Dr. H. E. Bond, NCI.

c. A three-week laboratory session, part of the "Analytical Ultracentrifugation" course offered by the NIH Graduate Program, FAES, was attended by 26 students. Instructors were Dr. Samuel Luborsky, NCI, and Dr. Marc Lewis, NINDB.

d. A 30-week course on "Instrumentation Electricity," tailored to medical equipment for medical equipment repairers, met for $1\frac{1}{2}$ hours per week. Ten SMS medical equipment repairers participated. Mr. Leonard Aberbach, SMS, was the instructor.

6. Equipment Utilization

In cooperation with the Supply Management Branch, BEIB has developed the mechanism for utilization of used scientific equipment. When items are declared excess to SMB, the property transfer orders are routed through BEIB, who inspect the equipment and judge the feasibility and cost of repair. When advisable, BEIB restores the equipment to good condition.

The SMS, BEIB, maintains a comprehensive inventory of useful scientific equipment which is made available for loan to NIH researchers on a request basis. When a request to use a device is for one year or more, a property transfer is arranged. When the request is for short-term use, it is loaned without cost and then returned to the loan pool.

BEIB also maintains a sizable number of certain classes of equipment to replace components when the user's equipment is in the shop for repairs.

At the present time, there are about 400 items in the loan pool. Approximately 100 of these are on loan at any given time. Over the course of the past year, approximately 100 items have been acquired from SMB's excess property, refurbished by BEIB, and transferred to users on a permanent basis.

7. Satellites

a. The Building 10 Maintenance Unit has been reorganized to improve coordination of technical services and support for Clinical Center programs. It has been renamed the Building 10 Satellite Unit and placed under control of the Assistant Chief for Technical Services, BEIB.

b. Approval has been obtained for establishment of a new satellite technical support unit for the National Cancer Institute in Building 37. Operations are expected to commence early in FY 1969.

D. Problems

1. Personnel

Increased Federal salaries, improved recruitment practices, and generally more progressive application of policies and procedures have enabled the Branch to improve its support to the NIH intramural research program. However, its potential is yet far from being realized.

Ceilings restrictions in effect throughout the fiscal year have drastically curtailed program developments in the important areas of artificial organs, materials development, and mechanization and automation of laboratory and clinical procedures. The restrictions, unfortunately, have been imposed at a time when the needs of these critical program areas require and can attract well qualified and highly motivated professional people.

The ready availability of superior Commissioned Corps engineers and scientists has been an enormous boon to BEIB professional development. Many of these, however, anticipate tours of duty no longer than two years. The need exists to emphasize recruitment of career civil servants at high professional levels to assure stability for the future.

2. Space

The acquisition of 5,600 square feet of new space in Building 13 in 1967 temporarily relieved a serious problem of overcrowding that is now recurring. The Systems Maintenance Section, to which the bulk of the new space was allocated, has experienced a 39 percent increase in Building 13 staff during 1968. There has been no increase in available space.

Had not drastic personnel ceiling restrictions been imposed during the year, overcrowding for the engineering sections would now be most serious. It is essential that appropriate measures be planned for the time when such constraints are relaxed.

It is expected that expansion of the equipment utilization program will soon require additional space adjacent to the Systems Maintenance Section.

Renovation of the Building 10 Satellite Unit space has relieved the problem of overcrowding in that area somewhat. Additional adjacent space is still required, however, if the satellite is to fulfill its purpose most effectively.

E. Program Plans

The Electrical and Electronics Engineering Section and the Mechanical Engineering Section have been brought to near "critical" size for the level of current operations. The Chemical Engineering Section has clearly demonstrated the innovations that the field it represents can introduce into health research. Unfortunately, severe personnel ceiling constraints have curbed its intended growth rate, and it remains far below "critical mass." Continued emphasis will be placed on improving the engineering sections in terms of numbers and professional competence, with special attention being given to Chemical Engineering.

Progress continues in the level of contribution by BEIB scientists and engineers to NIH research programs. The innovating and developing of new concepts and their acceptance by intramural scientists have grown consistently. The Branch expects to continue its efforts in promoting these trends and extending work in areas such as physiological monitoring for patient care, new diagnostic and surgical tools, mechanization and automation, artificial therapeutic devices, laser technology, physiological systems analysis, and biomaterials. Other major issues that may be encountered include:

1. Implementation of a new NIH organization for more comprehensive coordination of engineering and physical sciences with medicine and biology.
2. Installation and operation of an NIH-wide economic scientific equipment utilization program.
3. Establishment of additional satellite technical support units.
4. Improvement of mechanisms for development and transfer of engineering innovations to biomedical research applications within the NIH structure.

F. Publications, Presentations

1. Publications

Battig, C. G.: Checking for electrical shock hazards. Anesthesiology. (In press)

_____: Electrosurgical burn injuries and their prevention. JAMA. (In press)

Bischoff, K. B. and Dedrick, R. L.: Pharmacokinetics of artificial kidney therapy for poisons. In Proceedings of the Annual Conference on Engineering in Medicine and Biology, 1967, Boston, Mass. The Conference Committee for the 20th Annual Conference on Engineering in Medicine and Biology. Murray Eden, Chairman, MIT, 1967, Vol. 9, p. 8.6. (Paper presented in Boston, Nov. 1967.)

_____ and _____: Thiopental pharmacokinetics. Journal of Pharmaceutical Sciences. (In press)

_____: Discussion of correlations of blood coagulation with surface properties of materials. Journal of Biomedical Materials Research. (In press)

Boretos, J. W. and Pierce, W. S.: Segmented polyurethane: a new elastomer for biomedical applications. Science 158:1481-1482, Dec. 16, 1967.

_____: Procedures for the Fabrication of Segmented Polyurethane-polymers into Useful Biomedical Prostheses. Bethesda, Md., Bldg. 13, Rm. 3W13, NIH, 1968, 16pp.

Cohen, G. S.: A data acquisition system for psychophysiological research on newborns. In Proceedings of the Annual Conference on Engineering in

Medicine and Biology, 1967, Boston, Mass. The Conference Committee for the 20th Annual Conference on Engineering in Medicine and Biology. Murray Eden, Chairman, MIT, Vol. 9, p. 25.2. (Paper presented in Boston, Nov. 1967.)

_____: Design of the operating room, In Segal, B. L. and Kilpatrick, D. G. (Eds.): Engineering in the Practice of Medicine. Baltimore, The Williams and Wilkins Co., 1967, pp. 75-82.

_____: State of the art: intensive care equipment. Proceedings of 6th National ISA Biomedical Sciences Instrumentation Symposium. (In press) and Instrumentation Technology. (In press) (Paper presented in Pittsburgh, Pa., May 1968.)

Dedrick, R. L., Bischoff, K. B., and Leonard, E. F. (Eds.): The artificial kidney. Chemical Engineering Progress Symposium Series, No. 84, New York, American Institute of Chemical Engineers, 1968, Vol. 64, 123 pp.

_____ and _____: Pharmacokinetics in applications of the artificial kidney. Ibid. pp. 32-44. (Paper presented at meeting of AIChE, Tampa, Fla., May 1968, by Dr. Dedrick.)

_____: Observations on biomedical engineering. Transactions of the New York Academy of Sciences. (In press) (Paper presented in New York, Feb. 1968.)

Feigl, E. O., Simon, G. A., and Fry, D. L.: Auxotonic and isometric cardiac force transducers. Journal of Applied Physiology 23: 597-600, Oct. 1967.

Friauf, W. S.: Novel applications of feedback in biomedical instrumentation. In Proceedings of the Annual Conference on Engineering in Medicine and Biology, 1967, Boston, Mass. The Conference Committee for the 20th Annual Conference on Engineering in Medicine and Biology. Murray Eden, Chairman, MIT, 1967, Vol. 9, p. 35.1. (Paper presented in Boston, Nov. 1967.)

Gombos, E. A., Metz, H., and Chalifoux, H.: Development and organization of a large haemodialysis centre. In Kerr, D.N.S. (Ed.): Replacement of Renal Function. Proceedings of the Third Conference of the European Dialysis and Transplant Association, Lyons, France, June 1966. New York, Excerpta Medica Foundation, International Congress Series No. 131, 1967, pp. 117-121.

Goodman, L.: Biomedical engineering brings technical applications to problem solving in medical research, treatment. American Engineer, 18-19, Feb. 1968.

_____: Medical control systems. In revised edition, McGraw-Hill Encyclopedia of Science and Technology. (In press)

_____: Clinical implications of equipment characteristics. Proceedings of Meeting, Computer Applications in Clinical Electrocardiography, American College of Cardiology. (In press) (Paper presented at Washington, D. C., Nov. 1967.)

_____ and DeBroske, J. M. F.: The Shop. BIAC Information Module M17. Washington, D. C., BioInstrumentation Advisory Council, 1968, 8pp.

Hoye, R. C., Gart, J., Weiss, G. H., Riggle, G. C., and Ketcham, A. S.: Potential of laser oncolysis with pretreatment x-irradiation. Radiation Research 32: (No. 1) pp. 112-116, Sept. 1967.

_____, Riggle, G. C., and Ketcham, A. L.: Laser destruction of experimental tumor state of the art and protection of personnel. American Industrial Hygiene Association Journal 29: (No. 2) pp. 173-180, March-April 1968.

Ketcham, A. S., Hoye, R. C., and Riggle, G. C.: A surgeon's appraisal of the laser. Surgical Clinics of North America 47: (No. 5) 1249-1263, Oct. 1967.

Kolobow, T. and Dedrick, R. L.: Dialysate capacity augmentation at ultra-low flow rates with activated carbon slurry. In Schreiner, G. E. (Ed.): Transactions of the American Society for Artificial Internal Organs, Atlantic City, N. J., April 1966. Dr. G. E. Schreiner, Dept. of Medicine, Georgetown University Hospital, Washington, D. C. 1966, Vol. XII, pp. 1-6.

_____ and _____: Dialysate capacity augmentation with activated carbon slurry. In Kerr, D.N.S. (Ed.): Replacement of Renal Function. Proceedings of the Third Conference of the European Dialysis and Transplant Association, Lyons, France, June 1966. New York, Excerpta Medica Foundation, International Congress Series No. 131, 1967, pp. 375-377.

Leonard, E. F. and Dedrick, R. L.: The artificial kidney: problems and approaches for the chemical engineer. In Dedrick, R. L., Bischoff, K. B., and Leonard, E. F. (Eds.): The artificial kidney. Chemical Engineering Progress Symposium Series No. 84, New York, American Institute of Chemical Engineers, 1968, Vol. 64, pp. 15-31.

Norris, G. E., Banfield, W. G., and Chalifoux, H. D.: Tissue processor for automatic dehydration and infiltration of small specimens. Science Tools 14: 13-14, Apr. 1967.

Peterson, J. I.: Urinary glucose measurement. Clinical Chemistry (In press) (Paper presented at Symposium on Low Molecular Weight Urinary Constituents, Oak Ridge National Laboratory, Oak Ridge, Tenn., Dec. 1, 1967.)

_____: Gel electrophoresis destaining apparatus. Analytical Biochemistry (In press)

_____ and Young, D. S.: Evaluation of the hexokinase-glucose-6-phosphate dehydrogenase method of determination of glucose in urine. Analytical Biochemistry. (In press)

Pierce, W. S., Turner, Jr., M. C., Boretos, J. W., Metz, H. D., Nolan, S. P., and Morrow, A. G.: Mechanical left ventricular assistance: experimental studies using an implantable roller pump. In Schreiner, G. E. (Ed.): Transactions of the American Society for Artificial Internal Organs, Chicago, Ill. April 1967. Dr. G. E. Schreiner, Dept. of Medicine, Georgetown University Hospital, Washington, D. C., 1967, Vol. XIII, pp. 299-305.

Riggle, G. C., Hoyer, R. C., Ketcham, A. S., and Hawkins, R. W.: Development of a high energy neodymium laser system for surgical use. In Jacobson, B. (Ed.): Digest of the Seventh International Conference on Medical and Biological Engineering, Stockholm, Aug. 1967. The Organizing Committee for the International Conference on Medical and Biological Engineering, Sven Brohult, Conference Chairman, The Royal Academy of Engineering Sciences, Stockholm, 1967, p. 164. (Paper presented by Mr. Riggle in Stockholm, Aug. 1967.)

Turner, M. C., Pierce, W. S., Fogle, J. L., and Boretos, J. W.: An implantable heart assist pump system. Ibid. p. 386. (Paper presented by Mr. Riggle in Stockholm, Aug. 1967.)

2. Presentations

Battig, C. G.: Burn hazards associated with the electrosurgical unit. Workshop for Electrical Hazards in Hospitals, National Academy of Sciences, Washington, D. C., April 1968.

Bischoff, K. B.: The chemical engineering kinetics laboratory. American Society for Engineering Education at Michigan State University, Michigan State University, East Lansing, Mich., June 1967.

Dedrick, R. L.: Kinetics of activated carbon kidney. American Society for Artificial Internal Organs. Chicago, Ill., April 1967.

_____: Biomedical engineering at NIH. Bioengineering Seminar, University of Maryland, College Park, Md., Oct. 1967.

_____: Biomedical engineering membership activities in the American Institute of Chemical Engineers. 20th Annual Conference on Engineering in Medicine and Biology, Boston, Mass., Nov. 1967.

_____: Biomedical engineering at NIH. Biomedical Engineering Seminar of Johns Hopkins University, Baltimore, Md., Dec. 1967.

_____: The structure and activities of BEIB. PHS Orientation Course for Engineers and Related Environmental Personnel, Cincinnati, Ohio, Jan. 1968.

_____: Artificial organs. Conference on "Science and Engineering of the Living System," Drexel Institute of Technology, Philadelphia, Pa., March 1968.

_____: The artificial kidney. Chemical Engineering Seminar of Princeton University, Princeton, N. J., April 1968.

Dedrick, R. L.: Engineering in medicine. Lecture - Engineering Faculty and Graduate Students, Oklahoma State University, Stillwater, Oklahoma, May 1968.

Goodman, L.: As NIH Project Officer, spoke on the objectives and needs of NIH as related to the interplay of engineering with biology and medicine at the first meeting of the NAS-NAE Study Group on Interplay of Engineering with Biology and Medicine, held at the National Academy of Engineering, Washington, D. C., Oct. 1967.

_____: Biomedical engineering activities of the American Society of Mechanical Engineers. 20th Annual Conference on Engineering in Medicine and Biology, Boston, Mass., Nov. 1967.

_____: Technology-medicine-information. Biological Sciences Section, Washington Chapter of the Special Librarians Association, Washington, D. C., Nov. 1967.

_____: Engineering developments for biology and medicine. DHEW Press Conference, Washington, D. C., Dec. 1967.

_____: Engineering in medicine and biology. The Fred Gale Show, Radio Station WWDC, Washington, D. C., Jan. 1968.

_____: Engineering for health at the NIH. Conference on "Science and Engineering of the Living System," Drexel Institute of Technology, Philadelphia, Pa., March 1968.

_____: Engineering for health at the NIH. University of Delaware Symposium Series on Bioengineering. Newark, Del., March 1968.

_____: Interviewed by Mr. Peter Hackes, NBC, on the topic of engineering in medicine on the NBC Television network program, "The Today Show," Washington, D. C., March 1968.

_____: Biomedical engineering at the NIH. University of Wisconsin, Madison, Wis., and Marquette University, Milwaukee, Wis., April 1968.

_____: Opportunities for new bioengineering inventions. Aerospace Industrial Life Sciences Association, Miami, Florida, May 1968.

Peterson, J. I.: Artificial organs. Biology classes of Wakefield High School, Arlington, Va., in observance of Science Day, April 1, 1968.

Pettitt, R.: Careers in biomedical engineering. Engineering students of Rensselaer Polytechnic Institute, Troy, N. Y., May 1968.

Riggle, G. C.: The laser as a tool for medical research. Washington Section, IEEE, Washington, D. C., Oct. 1967.

_____: Bio-physical effects of laser radiation. NCI Grand Rounds Program, Clinical Center Auditorium, NIH, Bethesda, Md., Oct. 1967.

_____: A team approach toward solving bioengineering problems. Combined seminar with University of Vermont College of Medicine and College of Technology, Burlington, Vt., May 1968.

_____: The laser as a tool for medical research. State meeting of Vermont Society of Professional Engineers, Burlington, Vt., May 1968.

Turner, M. C.: The engineering aspects of heart assist devices. Surgical Grand Rounds, University of Pennsylvania Hospital, Philadelphia, Pa., March 1968.

_____: (1) An environmental test kit for medical care facilities. (2) An implantable roller pump for cardiac assistance. Third Annual Joint Meeting, The Clinical Society and the Commissioned Officers Association of the U. S. Public Health Service, San Francisco, Calif., March 1968.

Serial No. DRS-BEIB-1

1. Biomedical Engineering and Instrumentation Branch
2. Chemical Engineering Section
3. Bethesda

PHS-NIH

Individual Project Report

July 1, 1967 through June 30, 1968

Project Title: Mathematical Analysis of Pharmacokinetics - Cancer Chemotherapy

Previous Serial Number: None

Principal Investigators: Robert L. Dedrick, Kenneth B. Bischoff

Other Investigators: David P. Rall, Daniel S. Zaharko, Vincent T. Oliverio

Cooperating Units: EXT-NCI, LCP-NCI

Man Years:

Total:	.3
Professional:	.3
Others:	.0

Project Description:

Objective: To extrapolate results obtained with small animals to rational therapeutic regimens in man.

Methods Employed: Appropriate mathematical models will be developed. Resulting equations will be solved numerically on a digital computer if required by their complexity. In vitro and in vivo studies will be performed to obtain necessary missing information.

Significance to Biomedical Research and the Program of the Institute: One of the major obstacles to progress in cancer chemotherapy is the inability to extrapolate reliably from results obtained with small animals to regimens for the treatment of cancer in man. A theoretical base to permit such extrapolation and to indicate areas in which insufficient information exists is of vital importance.

Proposed Course of Project: Techniques of mathematical modeling of drug distribution kinetics will be applied to cancer chemotherapeutic agents to account for species differences in tissue binding, metabolism, transport, clearance by the kidney, and removal by extrarenal routes. It is anticipated that preliminary work will indicate areas in which data are insufficient and suggest experiments that must be performed or approximations that can be accepted.

Serial No. DRS-BEIB-2

1. Biomedical Engineering and Instrumentation Branch
2. Chemical Engineering Section
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: Mathematical Analysis of Pharmacokinetics - Effect of Artificial Kidney

Previous Serial Number: DRS-BEIB-3 (1967 - Fixed Bed Processes for Blood Perfusion)

Principal Investigators: Robert L. Dedrick, Kenneth B. Bischoff

Other Investigator: Jerrold Bernstein

Cooperating Unit: LPHAR-NCI (Baltimore)

Man Years:

Total:	.3
Professional:	.3
Other:	.0

Project Description:

Objective: To elucidate the biochemical events that occur in the body during and subsequent to processing of blood in an extracorporeal device.

Methods Employed: A four-compartment mathematical model involving protein binding, lipid solubility, and metabolism was employed to predict barbiturate concentrations in the body as a function of time. The resulting set of non-linear differential equations was solved numerically on a digital computer and the results were compared with existing data.

Major Findings: Published pharmacokinetic data for thiopental in dog and man are successfully predicted by the model. The results are consistent with the limited clinical data available for removal of pentobarbital in a hemodialyzer or an activated carbon artificial kidney. The observed rebound in plasma concentration subsequent to cessation of perfusion is explained.

Significance to Biomedical Research and the Program of the Institute: The principal area of kinetic investigation reported in the artificial kidney literature has been the performance of the device. Very little information is available on the events that occur in the body during treatment of blood in an extracorporeal circuit. Such information is relevant to a number of important clinical problems including the "disequilibrium syndrome," the physiologic limits to drug, metabolite or poison removal, and the possible use of an artificial kidney as part of a regimen of chemotherapy.

Proposed Course of Project: It is anticipated that increasing emphasis will be placed on comparative pharmacology of cancer chemotherapeutic agents.

Publications:

Bischoff, K. B. and Dedrick, R. L.: Pharmacokinetics of artificial kidney therapy for poisons. Proc. Ann. Conf. Eng. Med. Biol. 9:8.6, Nov. 1967.

_____ and _____: Thiopental pharmacokinetics. J. Pharm. Sci. (In press)

Dedrick, R. L. and Bischoff, K. B.: Pharmacokinetics in applications of the artificial kidney. In Dedrick, R. L., Bischoff, K. B., and Leonard, E. F. (Eds.): The artificial Kidney. Chem. Eng. Prog. Symposium, Ser. No. 84, American Institute of Chemical Engineers, 345 East 47 Street, N. Y., N. Y. 10017, 1968, 64:32-44.

Serial No. DRS-BEIB-3
1. Biomedical Engineering and
Instrumentation Branch
2. Chemical Engineering Section
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: Segmented Polyurethane

Previous Serial Number: DRS-BEIB-1 (1967 - Heart Assist Pump)

Principal Investigator: John W. Boretos

Other Investigators: Don E. Detmer, Frank R. Wagner, Nina S. Braunwald

Cooperating Units: SB-NHI, National Bureau of Standards

Man Years:

Total:	.65
Professional:	.40
Other:	.25

Project Description:

Objective: To conduct research on segmented polyurethane directed toward evaluating its chemical and physico-mechanical properties. In addition, modifications of the polymer will be investigated to enhance its utilization for biomedical applications.

Methods Employed: Several specific areas of investigation are

1. Long-term implants - hydrolytic effects
2. Permeability
3. Particle fragmentation in heart pump sets
4. Polymer modifications

Major Findings: Four-month implants have shown no obvious changes in tensile strength. Further studies are designed to observe hydrolytic stability for periods up to at least two years.

Significance to Biomedical Research and the Program of the Institute: A stable elastomer with high strength properties and physiological compatibility is needed for clinical prostheses.

Proposed Course of Project: Continuation of the proposed evaluation work with the manufacturer of the basic polymer to make it available to the scientific community.

Publications:

Boretos, J. W. and Pierce, W. S.: Segmented polyurethane: A polyether polymer. An initial evaluation for biomedical applications. J. of Biomed. Materials Res. (In press)

_____ and _____: Segmented polyurethane: A new elastomer for biomedical applications. Science 158:1481-1482, Dec. 16, 1967.

Serial No. DRS-BEIB-4

1. Biomedical Engineering and Instrumentation Branch
2. Electrical and Electronic Engineering Section
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: Myocardial Infarction Research Unit Instrumentation and Data Acquisition Systems

Previous Serial Number: None

Principal Investigators: Robert J. Pettitt, Gerald S. Cohen

Other Investigators: Peter L. Frommer

Cooperating Unit: MI-NHI

Man Years:

Total:	2.5
Professional:	2.0
Others:	.5.

Project Description:

Objective: To improve methods for intensive patient study and coronary care via design and development of new instrumentation systems.

Methods Employed: Collaboration with NHI-MI program office and staff of Myocardial Infarction Research Unit (MIRU) centers on systems analysis and design of monitoring and control methods. Research and experimentation on new instrumentation techniques.

Major Findings: Design and technical specifications for the analog instrumentation and data acquisition system at the Massachusetts General Hospital have been completed. Research has produced several promising new techniques for data handling and cardiotelemetry.

Significance to Biomedical Research and the Program of the Institute: Advancements in analog instrumentation and data acquisition systems are essential to the general problem of health research and patient care.

Proposed Course of Project: Continued consultative support to the MIRU program office and to the MIRU centers with significant responsibility for technical aspects of the instrumentation system at the Massachusetts General Hospital. Research will continue on improved coronary care unit monitoring equipment.

Serial No. DRS-BEIB-5

1. Biomedical Engineering and Instrumentation Branch
2. Electrical and Electronic Engineering Section
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: Rat Identification System

Previous Serial Number: None

Principal Investigator: Walter S. Friauf

Other Investigator: Horace E. Cascio

Cooperating Unit: TD, NIMH

Man Years:

Total:	1.2
Professional:	1.2
Others:	.0

Project Description:

Objective: To identify individual rats out of a group of 500, at various points in a system.

Methods Employed: Rats will be identified as they pass through portals at test stations and other points in the system. Each rat will have a passive resonant implant which is excited at the portal. The period of the ringing frequency is sensed and used to identify the rat.

Major Findings: Prototype construction has verified the adequacy of the basic approach. Further effort will go into refining the design to allow the desired group size.

Significance to Biomedical Research and the Program of the Institute: This system will facilitate psychological studies where individual traits are important.

Proposed Course of Project: Initial operation with 2 portals and 16 rats is planned for June 1968, with real time interface to a computer for data logging. Then the number of rats and portals will be expanded. Later, real time use of the identification to program test conditions is contemplated.

Serial No. DRS-BEIB-6

1. Biomedical Engineering and Instrumentation Branch
2. Mechanical Engineering Section
3. Bethesda

PHS-NIH

Individual Project Report

July 1, 1967 through June 30, 1968

Project Title: Artificial Heart Assist System

Previous Serial Number: DRS-BEIB-1 (1967 - Heart Assist Pump)

Principal Investigator: Marshall C. Turner

Other Investigators: Glenn Rahmoeller, George A. Simon, Lester Goodman

Cooperating Unit: None

Man Years:

Total: .7

Professional: .6

Others: .1

Project Description:

Objective: Refinement of the roller pump system used in previous animal ventricular assistance with success.

Methods Employed: Fabrication and laboratory testing of design improvements, with particular attention to power sources, bearing lubrication, and other mechanical features.

Major Findings: Reliable operation for periods greater than one month has been achieved. A prototype for clinical use has been developed.

Significance to Biomedical Research and the Program of the Institute: An implantable roller pump for long-term in vivo use to investigate many aspects of cardiovascular response to assist devices is essential to progress of research on artificial organs.

Proposed Course of Project: A second series of calf implants, using the refined pump, is planned. Design work will continue on this and prototype clinical pumps.

Serial No. DRS-BEIB-7

1. Biomedical Engineering and Instrumentation Branch
2. Mechanical Engineering Section
3. Bethesda

PHS-NIH

Individual Project Report

July 1, 1967 through June 30, 1968

Project Title: Automated Serological Scanner System

Previous Serial Number: None

Principal Investigator: Courtney Mudd

Other Investigators: George A. Simon, Andrew J. Vargosko

Cooperating Unit: CP-CC

Man Years:

Total:	1.
Professional:	1.
Others:	0.

Project Description:

Objective: To develop a system for optical determination of the end-point titration in a hemagglutination (or HI) and complement fixation tests and store data for subsequent processing.

Methods Employed: Photodiodes measure light transmitted through each of 96 cells in test trays. Light level differences between positive and negative tests are electrically sensed and converted into binary form and punched onto a preassigned location on a standard IBM card.

Major Findings: The approach works well for the hemagglutination and HI tests with a preliminary mock-up reading approximately 90% of the tests correctly. The complement fixation test has not been implemented. Most incorrect readings are due to "slippage" of the red cells and "partials" which are neither positive nor negative but are usually read as positive.

Significance to Biomedical Research and the Program of the Institute: The method is capable of significantly improving accuracy and speed over traditional manual techniques.

Proposed Course of Project: Construct a preliminary model and evaluate its use and accuracy in the laboratory.

Serial No. DRS-BEIB-8

1. Biomedical Engineering and
Instrumentation Branch
2. Mechanical Engineering Section
3. Bethesda

PHS-NIH

Individual Project Report

July 1, 1967 through June 30, 1968

Project Title: Physical Correlates of Animal Colony Behavior

Previous Serial Number: None

Principal Investigators: James E. Mitchell, George A. Simon

Other Investigator: John B. Calhoun

Cooperating Unit: LP-NIMH

Man Years:

Total:	.4
Professional:	.3
Others:	.1

Project Description: ..

Objective: Develop data acquisition systems to monitor certain behavioral aspects of a large (500) rat colony and seek refined mathematical models of social behavior.

Methods Employed: Temporal and spatial monitoring of animal location and movement patterns together with automatic manipulation and registration of task-reward situations.

Major Findings: Prototype location and movement monitors are completed and are under evaluation. Prototype nesting and feeding station monitors are under construction.

Significance to Biomedical Research and the Program of the Institute: Experimental evaluation and verification of theoretical models of animal behavior are necessary to further understanding of human social phenomena.

Proposed Course of Project: This particular project is an early phase of a long-term research project requiring innovation and refinement of a series of measurement and analysis techniques.

Serial No. DRS-BEIB-9
1. Biomedical Engineering and
Instrumentation Branch
2. Office of the Chief
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: Automated Amino Acid Analysis

Previous Serial Number: None

Principal Investigator: John I. Peterson

Other Investigator: Erhard Gross

Cooperating Unit: LC-NIAMD

Man Years:

Total:	.7
Professional:	.7
Others:	.0

Project Description:

Objective: To develop an automated amino acid analysis instrument, particularly an automatic sample introduction system.

Methods Employed: Mechanical and chemical engineering design and testing of methods on a prototype instrument.

Major Findings: Two methods for automatic sample introduction have been successfully developed and design of an automated instrument completed.

Significance to Biomedical Research and the Program of the Institute: Automation of amino acid analysis will result in a considerable saving of laboratory manpower and expansion of capacity for routine sample handling.

Proposed Course of Project: Construction and thorough evaluation of instrument based on our designs, with subsequent extension to related laboratory procedures.

Serial No. DRS-BEIB-10

1. Biomedical Engineering and
Instrumentation Branch
2. Office of the Chief
3. Bethesda

PHS-NIH
Individual Project Report
July 1, 1967 through June 30, 1968

Project Title: Automated Sample Combustion System

Previous Serial Number: DRS-BEIB-9 (1967)

Principal Investigator: John I. Peterson

Other Investigators: Seymour Perry, Sidney Siegel

Cooperating Units: MB-NCI, RR-NICHD

Man Years:

Total:	.6
Professional:	.6
Others:	.0

Project Description:

Objective: The development of an automated system for preparation of samples for radiotracer scintillation analysis, using oxygen combustion.

Methods Employed: Experimental combustion techniques based upon extensions of the classic microanalytical combustion method.

Major Findings: The system has been completed for tritium analysis and is capable of treating samples up to 500 mg at a rate of 20 samples per hour with an error of $\pm 1\%$ and tritium recovery of 96%.

Significance to Biomedical Research and the Program of the Institute: This development can significantly reduce the time and cost involved in preparation of biological samples for radiotracer analysis.

Proposed Course of Project: The collection system for CO_2 must be perfected to allow use of the system for C^{14} labelled samples and will be followed by thorough evaluation and extension to related laboratory procedures.

Serial No. DRS-BEIB-11

1. Biomedical Engineering and Instrumentation Branch
2. Office of the Chief
3. Bethesda

PHS-NIH

Individual Project Report

July 1, 1967 through June 30, 1968

Project Title: Utility of Lasers in Biological Research and Clinical Applications

Previous Serial Number: DRS-BEIB-6 (1967)

Principal Investigators: Grant C. Riggle, Alfred S. Ketcham

Other Investigators: Woodrow F. Stotler, Robert C. Hoye

Cooperating Unit: SB-NCI

Man Years:

Total:	1.25
Professional:	.75
Others:	.50

Project Description:

Objective: To regulate and quantify laser energy and its effects on biological tissue as in several fields of medical research investigation. Emphasis is on cancer and neurology.

Methods Employed: Development of an extremely reliable, high energy system with controllable energy levels and pulse lengths and evaluation of effects by physical and physiological measures.

Major Findings: Distribution density and rate of delivery were significant factors in improving the destruction rate while reducing the dosage level. Marked improvement has been achieved in the predictability of tumor destruction using smaller dosage levels. High power laser action has produced insignificant effects and no further studies are contemplated at this time.

Significance to Biomedical Research and the Program of the Institute: Light energy has considerable promise for biomedical research, surgery, and therapy. Considerable fundamental and applied research and development is required to exploit its potential.

Proposed Course of Project:

1. A clinical unit is now functioning. Selected subjects from time to time will be treated to determine results of a controlled energy.
2. Investigation of results on human cancers with systems research on improving and overcoming problems related to patient treatment needs.
3. Continuation on the determination of biological effects resulting from a variety of laser wavelengths.
4. Development of systems for investigation of effects at cellular levels; secondary tumor regressions; and measurement of physical forces resulting from laser action.

DIVISION OF RESEARCH SERVICES

Summary of Branch Activities

July 1, 1967, through June 30, 1968

LIBRARY BRANCH

Jess A. Martin, Chief

I. SUMMARY

The NIH Library moved into a new facility providing more than twice as much total space, 42,500 square feet, and accommodating twice as many patrons as the former Library. The move was completed on April 29. Special sound reducing features in the new facility include a silent paging system and carpet in the Reading Room.

A journal collection evaluation was conducted by 75 scientists representing various subject specialties. A listing of periodical titles recommended for addition to the collection has been compiled. A list of titles recommended for deletion is in process.

The fourth year of the library internship program began in August. Two interns are given rotating work assignments to gain experience while making contributions to the service program. The NIH library internship program is one of only six now in existence in this country.

Automation within the Library Branch was concentrated in two areas: businesslike transactions, such as serials recording and acquisitions, and publications. Automation of circulation procedures, including overdue, was given some attention and will receive greater emphasis during the coming year.

Training of the staff was stressed. Courses in automation, systems design, psychology, and foreign languages were taken by professional staff members, with library principles and organization being studied by library technicians.

The Branch Chief announced his resignation effective July 15, 1968, to accept appointments as Director, Health Sciences Library and Associate Professor of Medical Librarianship at Temple University.

II. BRANCH PROGRAMS

A. Objectives

The primary mission of the Library Branch is to operate an efficient, comprehensive library in support of research and administrative programs. Activities of the Library include the acquisition, processing, maintenance, and circulation of materials; operation of a photocopying service; provision of informational, reference, consulting, and bibliographical assistance; and provision of a translating service for foreign scientific literature. To fulfill its mission, the Library is responsive to the changing literature

needs of the NIH investigator and is knowledgeable of the current manual and machine methods of handling scientific information.

B. Current Programs

Readers Services. Readers services for the NIH staff include reference assistance, circulation and maintenance of printed matter and micro-materials, photocopying, and translation.

The reference staff also compiles short reference lists and performs comprehensive literature searches as requested by NIH investigators. In order to answer the multitude of inquiries for specific information, reference librarians endeavor to keep abreast of the biomedical activities of NIH and other research institutions. They are also responsible for selecting new materials for the library collection.

The Circulation Unit, through surveillance and inventory of the collection, maintains the materials in a manner to encourage easier access for clientele. An extensive photocopy service within the Circulation Unit allows greater use of library literature. Another activity of this Unit, the interlibrary loan program, makes available books and journals not found in the NIH Library.

Still another important readers' service offered is the translation of foreign scientific literature. Ten foreign languages are handled by six staff translators. Other languages are translated by contract.

Technical Services. Technical Services include the acquisition of books, journals, technical reports, and micromaterials needed to support the research efforts of NIH scientists and the processing of these materials for use. Certain automated procedures now being implemented will reduce ordering and processing delays. A gift and exchange program permits valuable materials to be added to the collection at little cost to the Library.

Bibliographical Services. MEDLARS requests for NIH scientists are formulated by experienced searchers of the Bibliographical Services Section. Other programs of mechanized information handling are being planned and coordinated with existing programs at the Division of Computer Research and Technology, National Library of Medicine, Library of Congress, and other agencies. Responsibility for assisting the Institutes with the organization and development of satellite libraries rests with Bibliographical Services. Other functions include collection evaluation and user studies.

C. Program Progress and Accomplishments

The move of equipment, supplies, and personnel to the new library facility located on the first and first basement levels of the Clinical Center was begun on April 19 and completed on April 29. During the move limited service was provided at both the old and new locations.

The new facility features sound reducers in the form of carpeted floors, architectural curtains, and a silent paging system.

The automation programs of the Library continued with the coding of the history statement for periodicals being completed. Several library publications were computerized for the first time. The NIH Library Booklist, produced by the computer, was distributed in September with its frequency changed in January from bimonthly to monthly. Recent Translations and Translations Index, Supplement IV, 1967 were also computer produced. In an attempt to speed the up-dating of the In-Process List, a second keypunch was leased.

A study of the automation possibilities within the Circulation Unit as they relate to charging books and overdues was conducted by the Systems Analyst. Systems design has been delayed pending the gathering of additional data.

Training of the library staff involved coursework in systems concepts, design, facilities and analysis, psychology, and foreign languages. Library Technicians on the staff took courses entitled, "Introduction to Library Service," and "Principles of Library Organization." One staff member was provided in-house training as a reference librarian while actually serving as a circulation librarian.

The fourth year of the library internship program began in August, with the arrival of two interns. They are provided an opportunity to gain work experience in a research library while making a substantial contribution to its service program. Three of the first five interns elected to remain on the staff of the NIH Library. An internship brochure was distributed by the NIH Library to accredited library schools around the country.

Readers Services

Effective September 30, the responsibility for supervising the Library on weekends was transferred to five professional librarians of the Readers Services Section. Coverage for the Library is provided during the hours 8:30 a.m. to 12 midnight, seven days per week.

Photocopying Service. Xerox 720 and Xerox 914 photocopiers are used to fill urgent photocopy requests of 20 pages or less. Longer articles are photographed, processed, and then printed by the Xerox Copyflo. The faster copier (Xerox 720) will improve a service that has become the most heavily used of all library services. Approximately 75,000 pages per month are being copied for NIH scientists. An NIH photocopy operator continues to serve one-half time at the National Library of Medicine to assist in a program to provide one-day processing of the NIH interlibrary loan requests. Almost 80 percent of the requested articles were photocopied and returned to the NIH Library the same day. Photocopy film, formerly processed by a commercial firm, is now processed by the National Library of Medicine in an attempt to save time.

Circulation. A total of 39,000 books and journals were circulated during FY 1968. Approximately 7,500 were loaned, and 8,500 were borrowed from other libraries. Approximately 5,200 copies of translations were provided to other libraries.

The Borrower's File at the Circulation Desk was discontinued. Since some NIH groups did not clear through the Library, the cost of maintaining the file was not justified.

A study of the TWX Communication System in Libraries was conducted, and it appears that the system should be installed to speed the Library's interlibrary loan transactions.

Reference Service. Because emphasis is placed on supplying quick response to reference questions asked by phone or in person, reference librarians regularly scan the current scientific literature to keep abreast of the latest publications. The book and journal selections program is another responsibility of reference librarians. Included in this is a continuing search of journals, publishers' catalogs, national book catalogs, and announcements for current publications needed for the collection.

Translating. The first automated supplement to the NIH Translations Index was compiled and appeared as Supplement IV. The supplement again includes a subject index and a list of journal abbreviations. Each year approximately 500 articles are translated, with 85 of these being handled by contractors. Oral translations for the year consumed 1400 man-hours. Tape recordings of translations were provided on request.

Technical Services

Acquisitions and Cataloging. During this 12-month reporting period, the Library's collection was strengthened by the addition of 4,500 new books and by the receipt of 500 books through gift and exchange. For FY 1968, the Library placed subscriptions to more than 2,227 journal titles and received an additional 800 as gifts or on exchange.

The Acquisitions Unit began placing two-year, rather than one-year, subscriptions to several journal titles--a practice which reduces costs significantly.

Made available for the first time was an alphabetical list of periodicals which are on standing order. The list simplifies the book selection procedure presently being used.

Bibliographical Services

During the fiscal year 434 MEDLARS requests were handled by the Bibliographical Services Section. Most of the requests for MEDLARS services are now being formulated by personnel of the NIH Library rather than being sent directly to NLM.

Key punching of MEDLARS searches was begun at the NIH Library with the result that searches are now sent more quickly to the NLM computer. The new arrangement ensures faster service for NIH scientists.

A survey of the entire collection of the library is currently underway. Seventy-five scientists were asked to survey certain subject areas. Their work has been completed. A tabulation of their recommendations is now being compiled.

Five Institutes and Divisions are now receiving the monthly alerting service entitled, Information from the NIH Library. Distribution to all I/D's is being planned.

D. Problems

Deterioration of filmed translations appears to be the result of improper storage. Advice of Medical Arts and Photography Branch has been sought. Journal renewals placed with the Veterans Administration have not been handled effectively during FY 1968. Determination needs to be made whether VA should be retained as a primary vendor.

A careful re-evaluation of the role of the Library Committee should be conducted and new guidelines developed.

E. Program Plans

Study of other information retrieval systems that can be adapted for use by the NIH Library will continue.

The Systems Analyst, with assistance from other staff members, will automate the circulation procedures and give special emphasis to the time-consuming recall of overdues.

Evaluation of the collection will continue, with NIH scientists providing expertise and subject knowledge that are invaluable to this type of program.

A fifth medical library internship program conducted by the NIH Library is planned for 1968/69, beginning in August.

F. Publications

Martin, J. A. What Happens to Medical Library Interns? Bulletin of the Medical Library Association, Vol. 55: October 1967.

Martin, J. A. Planning the New NIH Research Library. Special Libraries Vol. 59: January 1968.

National Institutes of Health Library: NIH Library Booklist. Bethesda, Md., monthly.

National Institutes of Health Library: Periodicals Currently Received in the NIH Library, 1967. U. S. Dept. of Health, Education, and Welfare, Public Health Service Publ. No. 1313. Washington, D. C., U. S. Govt. Print. Off., 1967.

National Institutes of Health Library: Recent Translations, a Selected List. Bethesda, Md., monthly.

National Institutes of Health Library: Index of Translations, Supplement IV. Washington, D. C., U. S. Govt. Print. Off., 1968.

National Institutes of Health. NIH Library Guide. Bethesda, Md. 1968.

DIVISION OF RESEARCH SERVICES

Summary of Branch Activities

July 1, 1967 through June 30, 1968

MEDICAL ARTS AND PHOTOGRAPHY BRANCH

Charles C. Shinn, Chief

I. SUMMARY

The Medical Arts and Photography Branch provides the knowledge, skills, and techniques for visually communicating research information, for preserving observations of NIH scientists, for recording research activity, and for preparing effective research reports.

Professional designers provide not only visual presentations such as motion pictures, slides, exhibits and publications, but counsel and advice on selection of appropriate media and effective methods for achieving desired results.

In the first half of the year, the Branch operated without a full-time Chief. The Administrative Officer position became vacant, and the Branch continued to lose key employees through transfers and retirement. In December 1967, Mr. Charles C. Shinn reported for duty as Branch Chief to begin a period of orientation and assumption of full-time leadership.

In FY 1968, the Branch handled a greater volume of work than in previous years. For example, 26,600 requisitions for work were handled as compared to 22,600 in FY 1967, the previous high. It is noteworthy that the total Branch staff is the same today as it was in 1965, while work requests processed were up 61 percent in 1968 over 1965. Part of the increased productivity was achieved through use of new automatic processing equipment. Increased use of outside contracting and overtime also helped. During the latter part of the year, several policies and standardized work procedures were instituted to further improve production. In addition, limited shifting of personnel and the recruitment of young artists for temporary employment and for work-study arrangements were begun. A long-range program including training and work evaluation was started.

Plans were completed for moving the Branch to its new central location in the Library Annex of the Clinical Center. This centralization of Branch activities should greatly benefit all of the major programs. More efficient management and administration, simplified work reception, measurement, and work flow, centralized quality control, spot checking of work in process, as well as day-to-day design and performance reviews will soon be possible. To this end a central Branch conference/presentation/planning room is contemplated. A convenience to clients whose work involves several activities of the Branch also will accrue.

A task force on centralized work control and workflow analysis was formed late in FY 1968 with final recommendations due prior to the move to new quarters scheduled for late August 1968.

A number of important management changes were made during the year.

II. BRANCH PROGRAMS

A. Objectives

The objective of the Branch is to provide a central, high-quality source of design, art, and photographic services in support of research programs at NIH. The Branch provides a central capability for rapidly responding to individual research scientist needs, for recording on-going research activity, and for reporting research findings in any of the visual media to both professional and public audiences.

It is also the objective of the Branch in meeting NIH research program needs, to provide in-house services on a professional basis competitive with commercially obtainable services at the lowest possible cost, to do necessary research and development of tools and techniques to improve art and photographic service, and to develop specialized capabilities, particularly in still and motion picture photography and in medical art and model making, tailored to NIH needs.

The Branch monitors procurement of art and photographic services by outside contract, serving as technical adviser and counsellor in obtaining the needed additional services at the lowest cost consistent with high quality.

B. Current Programs

The programs of the Branch include still and motion picture photography including photomacrography, photomicrography, time-lapse and high-speed cinematography, general photography, and related laboratory services; visual arts production including publications design and general graphics; visual aids including slides, vu-graphs, and other projectables; animation art work; technical, general, and medical illustration; exhibit design; statistical drafting; display charts; and medical models.

C. Program Progress and Accomplishments

In FY 1968, the Branch handled a greater volume of work than in any previous year. For example, 26,600 requisitions for work were processed as compared to 22,600 in FY 1967, the previous high mark. Approximately 87,000 ft. of motion picture film was exposed as compared to 70,000 in 1967 and 30,000 in 1966. Both major and minor motion picture production increased. Approximately 190,000 photographic prints were processed; approximately 80,000 2x2 color slides were made. Lantern slide production decreased to about 10,000, being gradually replaced by the 2x2 size. The switch to the more popular size also resulted in some material savings.

Photographic contract work reached a new high as did outside contracting for exhibits, art work, and statistical drafting. For example, outside contract services for art work and exhibits processed by the Branch reached \$75,000; \$31,000 was spent on procuring outside charts, tables, and statistical drafting. Money spent outside on exhibits is primarily for construction. This is more feasible and economical and should continue.

However, a greater in-house capability for handling design, art work, and statistical drafting could save money, especially during peak periods. A study of contract work in this area during a peak period from February through April 1968 revealed that outside contracting cost \$14,800. It is estimated that the same work could have been accomplished in-house at about one-third the cost.

Perhaps the most progress was made in the motion picture program. A high-speed motion picture capability became fully operational and already has satisfied a number of requests for services. Primary application was in pulse laser impact investigations. It centers around a Hycam 400 ft. camera. Modifications to equipment increased our capability from 9,000 pictures per second for only 0.75 seconds to 11,000 pictures per second for a period of 2.175 seconds. This important improvement produced a higher percentage of successful photography because of the longer, workable period of time and greater latitude. High-speed photography is expected to increase as numerous investigators have expressed enthusiasm about demonstrated capabilities of the system.

As a result of experimentation and development of the high-speed camera, an original prototype high-speed camera exposure computer was designed. This unique device, based on a Polaroid picture exposure, greatly simplifies and speeds up calculations to obtain proper exposure for high-speed cameras. Clarification of patent possibilities for this device has been requested.

A portable time lapse cinephotomicrography service was established. It is now possible for research investigators to obtain a complete setup for time lapse cinephotomicroscopy using the researcher's laboratory photomicroscope. MAPB provides instruction in its use as needed. Upon completion of projects, the camera equipment is returned to MAPB for subsequent release to other investigators.

The use of a teleprompter was instituted. It proved invaluable in achieving satisfactory synchronous sound photography.

The Steenbeck editing system became fully operational. This has speeded up and improved the whole film editing process.

Interrelationships with clients during pre-production planning and writing of motion picture research reports were improved. The sketchy, disoriented approach that handicapped the film program in previous years has been drastically changed. Further education of clients to motion picture production requirements hopefully will reduce the problem.

Following is a list of the more significant motion pictures and film strips completed during the past year:

1. "Case Studies of Oral and Pharyngeal Form and Function". This two-part motion picture research report was used as an integral part of an award-winning NIDR exhibit. Copies were prepared in 8mm sound, color for use in endless loop cartridges.

2. "Impulse Propagation in a Nerve Fiber". This research report for NINDB employed conventional and computer animation. It is in 16mm color, sound, 20 minutes in length.

3. "Extended Resection of Basal Cell Carcinoma of the Scalp, Brain and Face". This 16mm sound, color research report for NCI is 20½ minutes in length.

4. "Artificial Kidney". This public information film for NIAMD is 16mm sound, color, 14½ minutes in length.

5. "Surgical Correction of Vascular Obstruction of Superior Infundibulum". This research report is 16mm sound, color, 22 minutes in length.

6. "Left Ventricular Bypass with a Roller Pump", is a 16mm sound, color research report; 11 minutes in length.

7. "Patient Memory Tests". This title was produced as two films: one sound, one silent. The films are for use by the Geriatric Section, NICHD. Both films are black and white and run 16 minutes each.

8. Two lengthy 35mm black and white film strips were prepared for NIMH to be used in visual tests. They required critical tone control and unusual precision in the preparation of art work and in final photography.

9. "Laser Surgery of Melanoma on Mouse". This high speed footage in color was successfully accomplished at 11,000 frames per second.

The development of a life-size, flexible plastic eye model was completed. This project, over two years in process, represents the combined efforts of many personnel in the Branch. Research and development progressed from a rigid model to a final flexible model demonstrating the entire normal fundus. The artificial eye has been used at NIH for demonstrating ophthalmic instruments and techniques. Trials indicate that it will be useful for practice in direct and indirect ophthalmoscopy, fundus photography, slit-lamp examination, and many experimental setups for laboratory work. It will eliminate the need for human subjects in some cases.

The production of medical models and moulages increased, reflecting changing Institute programs and development of increased expertise in Branch services. Improvements were made in the jeltrate casting procedure to give smoother, more flexible molds that produce perfect casts without loss of detail.

Significant contributions in clarifying surgical technique and procedure in motion pictures were made by adapting medical illustration to the motion picture medium. Medical illustrations clarified and oriented the audience to changing positions of camera and patient. A significant example was in the NCI motion picture "Extended Resection of Basal Cell Carcinoma of the Scalp, Brain and Face".

Statistical drafting, general graphics and art work, exhibits, publications, animation art and art work for slides, charts and tables to illustrate scientific papers, all reached new, high levels of production. In addition, work processed through the Branch to outside contractors reached all time high levels. The ability to meet short deadlines improved--sometimes at the cost of quality.

A number of pieces of new equipment and invaluable work tools were added. For example, ozalid diazo process equipment was added to streamline production of film titles and copy for slides. The process cut the unit cost of titles and certain types of slides. Improvements in technical photography were made, particularly in handling heavy volume of gross specimens illustrating various types of artificial heart valves, effect of materials on living tissue, rejection of materials, valve design, etc.

Specialized methods of photographing immuno-electrophoresis plates in the study of protein reactions was perfected. Photography was scheduled in coordination with research efforts. It served as a laboratory record.

Photomicrography of agar gels showing migration of antibodies was perfected to demonstrate the path and effect of the migration. The photographs served as a basis for laboratory computations.

Ultra violet fluorescent photomicroscopy improved. As a result of increased demand, an additional photomicroscope with accessories for 35mm production was purchased. Further experimentation is under way with high-speed color film and special film processing to photograph living cells at low excitation levels under high magnification and ultra violet radiation.

Overall progress has occurred in coordination of activities among the Sections of the Branch. Regular weekly Section Chief meetings center on this objective. For example, art work for color slides, motion picture animation, titles, large presentation charts, etc., is becoming more carefully coordinated in design stages at inception of assignments. More rapid progress in this area should occur when the Sections are brought together in FY 1969.

Among the more important management improvements made during the year are the following.

1. Consolidated purchase orders for two Sections are now placed at regular intervals. Previously, they were placed individually, at random as needs occurred.

2. Standards were established with the Government Printing Office for NIH signatures on medical illustrations. Samples supplied by the GPO are accepted by MAPB as a general guide; exceptions are to be made on individual basis.

3. A policy for central clearance of publications design and art work was established within the Branch.

4. A single, responsible liaison officer was designated to represent the Branch on all printing problems with the NIH Printing and Reproduction

Section and with the Government Printing Office on matters of design.

5. A new photographic release procedure and form were developed and established.

6. A policy was established in the Branch for clearance of all art work for use in motion pictures and television.

7. A clearance procedure for both motion picture research recording and motion picture research report productions was established with Scientific Directors of the Institutes and Divisions.

8. Design and production of 30 x 40 presentation charts, particularly those for Congressional hearings, were standardized for more rapid, effective production.

9. A unified, improved reporting system for Section activity was developed within the Branch.

10. Basic statistical charts measuring production were established and are updated regularly.

11. Art work for 2x2 slides, 3-1/4 inch slides, television and motion pictures was standardized as to original size and scale.

12. All accumulated motion picture footage at NIH was sent to the Federal Records Center for archiving, subject to 24-hour retrieval notice.

D. Problems

The loss of personnel and the difficulty in finding replacements is a continuing problem. This shortage of qualified medical illustrators, top flight graphic designers, and scientifically oriented photographers and photo laboratory technicians still exists.

A relatively low pay structure at NIH, coupled with the need to attract personnel away from the center of commercial activity in mid-city, contributes to the handicap in competing for the limited number of available candidates.

Much can be done to re-orient, upgrade, and structure positions now in the Branch. On the positive side, appointment of a well-qualified Motion Picture Section Chief at higher pay is directly responsible for the surge forward in the motion picture program.

Over the long range, specific positions, particularly in shortage categories, should be upgraded to attract better quality personnel, at the same time providing an infusion of new, younger talent.

A high proportion of the staff is approaching retirement age or years in which the pace can be expected normally to slow. With increased technical development and more sophisticated equipment, a continuing effort to recruit new, young talent with emphasis on formal education in the arts and on technical training is necessary.

Another problem is preventive maintenance and routine replacement of worn equipment. Commercial resources for maintenance have not proved adequate, nor is there a plan for preventive maintenance, identification of obsolescence, and scheduled replacement. During the coming year, a program will be developed.

Analysis of funds spent on work sent to outside contractors reveals that they will exceed costs of work done in-house. At the same time, there is a direct cost and loss of effort in handling this work that has not been taken adequately into account in measuring work produced or in staffing.

More effective contract work handling and monitoring by the Branch to improve quality and to identify better contractors will produce consistently higher results. Greater in-house capability in peak periods needs to be developed. Preplanned use of temporary employees and a modest increase in permanent staff seems to be the most promising solution. Proposals along these lines are being developed.

Although the new centralized Branch space offers many previously defined advantages, it also presents serious deficiencies. Some can now be identified and corrected--for example, the lack of adequate sound proofing and control in the motion picture studio.

The effect on morale and performance of creative artists, designers, and others working continuously in windowless, subterranean space may be a problem.

E. Program Plans

The coordination of work by the Branch Sections has improved but still could be better. During the coming year, results of the task force on work flow and work control, coupled with the move into the new quarters, will provide opportunity to consistently coordinate talent, training, development, and performance of personnel.

A modest reorganization is anticipated along broad functional lines. It is needed to capitalize upon existing skills and talents, to cope with increased work loads, to take advantage of opportunities provided by the new central space, to more carefully define duties and measure performance, to improve supervision, and to attract the best talent available.

Until now the Branch has produced motion pictures with portable sound equipment. In the coming year, the sound studio in the new Branch space will be equipped with a quality sound recording facility. An engineering study is now underway which will result in sound proofing recommendations and identification of appropriate sound recording equipment, a major contribution to motion picture quality.

It is hoped that much of the effort can be saved that is now diffused through NIH Institutes and Divisions where individual draftsmen, photographers, and practitioners are isolated. At present, the Branch finds itself patching much inadequate work done elsewhere to reach minimum reproduction requirements.

Finally, a coordinated effort will be made to improve attitudes, develop more professional behavior, and establish identity as experts in visual communication. The result should be a more broadly based, better integrated service with objectives more critically identified.

Over the long run, it is hoped that a higher standard of performance will emerge.



<http://nihlibrary.nih.gov>

10 Center Drive
Bethesda, MD 20892-1150
301-496-1080

